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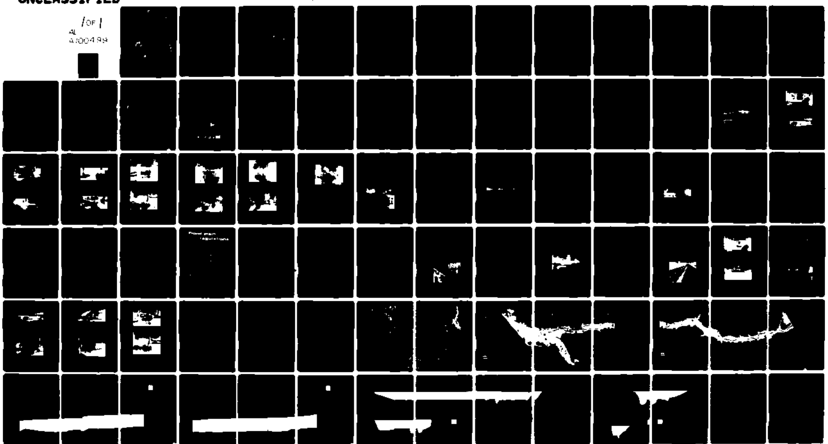

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# FLOOD PLAIN INFORMATION

## CUYAHOGA RIVER

# MANTUA AND HIRAM

# PORTAGE COUNTY

# OHIO












PREPARED FOR

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER

AND

TRI-COUNTY REGIONAL PLANNING COMMISSION

BY

CORPS OF ENGINEERS, U.S. ARMY
BUFFALO DISTRICT
APRIL 1972

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

# REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

**1. REPORT NUMBER**

**2. GOVT ACCESSION NO.** AD-A100 499

**3. RECIPIENT'S CATALOG NUMBER**

**4. TITLE (and Subtitle)**

Flood Plain Information Cuyahoga River
Mantua and Hiram
Portage County, Ohio

**5. TYPE OF REPORT & PERIOD COVERED**

Final

**6. PERFORMING ORG. REPORT NUMBER**

**7. AUTHOR(s)**

**8. CONTRACT OR GRANT NUMBER(s)**

**9. PERFORMING ORGANIZATION NAME AND ADDRESS**

U.S.Army Engineer Distrist, Buffalo
1776 Niagara Sreet
Buffalo, New York 14207

**10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS**

**11. CONTROLLING OFFICE NAME AND ADDRESS**

U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, New York 14207

**12. REPORT DATE**

1972

**13. NUMBER OF PAGES**

59

**14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)**

**15. SECURITY CLASS. (of this report)**

**15a. DECLASSIFICATION/DOWNGRADING SCHEDULE**

**16. DISTRIBUTION STATEMENT (of this Report)**

Distribution Unlimited

**17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)**

**18. SUPPLEMENTARY NOTES**

**19. KEY WORDS (Continue on reverse side if necessary and identify by block number)**

Floods
Flooding
Cuyahoga River

**20. ABSTRACT (Continue on reverse side if necessary and identify by block number)**

The objective of this report is that the data contained wili be used as a guide by the planners, and local officials for effective and workable legislation for the control of land use within the flood plain. In order that this objective may be obtained this report is intended to provide planners and local governments with technical information on the largest known floods of the past and to present data on possible future floods, such as, the Intermediate Regional Flood and the Standard Project Flood.

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## INTRODUCTION

In many areas of the Country the prospect of using protective works to alleviate possible flood damages effectively has reached the point of diminishing returns. This increase in flood damage potential, despite great expenditures on flood control, is greater than it ever was. This increase in flood damages is the result of rapid growth of flood damageable developments in the flood plain, occurring at a rate greater than that of providing flood control works. Flood damages have affected man's environment significantly. They have threatened his life and health, his property, his business or his place of employment. An obvious solution to this problem is to exercise greater wisdom in the use of flood plains. However, such wisdom cannot be exercised unless there is adequate knowledge of the flood hazard and a will on the part of the users of the flood plains to plan with the hazard in mind. Effective, sound land use in floodable areas through the use of regulatory powers has not been used extensively until recent years but is now receiving greater acceptance. It is now time to accelerate and enforce sound land use regulations in order to reduce future flood damages. Because man is powerfully attracted to the use of flood plain areas, Flood Plain Management practices are not likely to eliminate flood damages completely. However, they certainly can reduce them and therefore, should be given consideration by both planners and local governments.

This flood plain information report on the Cuyahoga River through the Village of Mantua and Townships of Mantua and Hiram has been prepared at the request of the Tri-County Regional Planning Commission through the Ohio Department of Natural Resources. It will be distributed to local interests through both of the above agencies.

The objective of this report is that the data contained herein will be used as a guide by the planners and local officials for

effective and workable legislation for the control of land use within the flood plain. In order that this objective may be obtained this report is intended to provide planners and local governments with technical information on the largest known floods of the past and to present data on possible future floods, such as, the Intermediate Regional Flood and the Standard Project Flood. The Intermediate Regional Flood has a frequency of occurrence in the order of once in 100 years, which means that over a long period of say 500 years, the magnitude of this flood would probably be equalled or exceeded five times, or on the average of once every 100 years. A flood of this magnitude is simply defined as having a one percent chance of being equalled or exceeded in any given year. The Standard Project Flood is a rare occurrence and, on most streams in Ohio, is considerably larger than any flood that has occurred in the past. The area referred to as a flood plain in this report, is the area that would be inundated by the Standard Project Flood. The frequency of occurrence of the Standard Project Flood is rare. However, it is recommended that when development within the flood plain is planned, consideration be given to the levels of possible future floods, including the Standard Project Flood.

This report is based on hydrological facts, historical and recent flood heights, and technical data having a bearing on the occurrence and magnitude of floods within the study area.

Included in this report are maps, profiles, photographs, and cross sections which indicate the extent of flooding that has been experienced and that which might occur in the future. These data, if properly used, can be very beneficial in wise flood plain management. From the maps, profiles, and cross sections in this report the depth of probable flooding at any location may be determined which would result from a recurrence of one of the past floods or by the future occurrence of either the Intermediate Regional Flood or the Standard Project Flood. Based on this information, future construction may be planned high

enough to avoid flood damages or, if at lower elevations, with recognition of the chances and hazards of flooding. In either case, the risks involved and the alternatives available should be considered.

This report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further study and planning on the part of local governments within the study area in arriving at solutions to minimize future flood damages. This can be accomplished by local planning programs to guide essential developments by controlling the type of use made of the flood plain through zoning, building codes, health regulations and other regulatory methods. Another means in which local flood plain management can be accomplished is through public acquisition of land for a low development use such as recreation.

Pamphlets and guides pertaining to flood plain regulations, flood proofing, and other related actions have been prepared by the Corps of Engineers. They are made available for use of State agencies, local governments and citizens in planning and taking action to reduce their flood damage potential.

The Buffalo District of the Corps of Engineers will, upon request, provide technical assistance to Federal, State and local agencies in the interpretation and use of the information contained within this report and will provide other available flood data related thereto. Information available includes high water mark elevations, bench marks, and sample flood plain regulations.

## SUMMARY OF FLOOD SITUATION

This flood plain information study covers the area along the Cuyahoga River from the South Mantua Village line, stream mile 68.75, to the Portage-Geauga County Line, stream mile 76.32. Within the 7.6-mile study area the Cuyahoga River flows through the Village of Mantua and Mantua and Hiram Townships. These communities are in Portage County. Their locations are shown on plate 1.

Presently there are eight U. S. Geological Survey water-stage recording stations in the Cuyahoga River basin. The locations of these gaging stations are shown on plate 1. The closest gaging station to the study area is just downstream of Winchell Road in an area known as Hiram Rapids. This station measures the flow from a drainage of 151 square miles. Records published by the United States Geological Survey are available for this station from August 1927 to December 1935 and from October 1944 to the present.

Local government officials and property owners adjacent to Cuyahoga River have been interviewed, and newspaper files and historical documents have been searched for information concerning past floods. From these data and studies of possible future floods on the Cuyahoga River, both the past and future flood situation has been developed.

THE GREATEST FLOOD - The greatest known flood recorded on the Cuyahoga River at the Hiram Rapids gage occurred on 23 January 1959. Based on existing development, its peak flow at the Hiram Rapids gage has a frequency of occurrence in the order of once in 25 years.

INTERMEDIATE REGIONAL FLOOD - The Intermediate Regional Flood is a flood that has an average frequency of occurrence in the order of once in 100 years. As shown on plates 7 and 8, the January 1959 flood averages about 1.5 feet lower than the Intermediate Regional Flood throughout the study area. Peak discharges during an Intermediate

Regional flood on the Cuyahoga River are estimated as 4,900 cfs at the Hiram Rapids gage and 5,100 cfs at the downstream limit of the study area. Table I compares the Intermediate Regional and Standard Project Floods with the January 1959 floods at selected locations in the study area.

STANDARD PROJECT FLOOD - The Standard Project Flood is a flood resulting from a severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the drainage basin under study. The Standard Project Flood is not assigned a frequency. Its water surface is considered by the Corps of Engineers to be the upper limit of the flood plain. Estimated Standard Project Flood discharges and stages at selected locations are listed on table I.

MAIN FLOOD SEASON - The highest discharges recorded in the Cuyahoga River at the Hiram Rapids gage normally occur between December and April. However, it is possible for flooding to occur in any month of the year. Flooding during the winter and spring months is normally the result of melting snow accompanied by moderate amounts of rainfall. Intense local thunderstorms during the summer and fall can also produce flooding.

FLOOD DAMAGE PREVENTION MEASURES - The communities within the study area have continually requested assistance from both the State and Federal Governments to alleviate their flood problems. However, the frequency of flooding and the damages suffered do not economically justify the required expenditure for a flood control project and the communities do not have sufficient funds to construct a project on their own. This is indeed unfortunate for those people who have been allowed to build in the flood plain. It appears from the results of past studies that the communities should not encourage future development in the flood plain. Rather, as a preventive measure flood plain regulations should

TABLE 1

RELATIVE FLOOD HEIGHTS ON THE CUYAHOGA RIVER

| Location | Mile Above Mouth | Flood | Estimated Peak Discharge (cfs) | Above 1959 Flood (feet) |
|---|---|---|---|---|
| Mennonite Road | 70.19 | January 1959 | 3,800 | 0 |
| | | Intermediate Regional | 5,100 | 1.1 |
| | | Standard Project | 18,300 | 10.7 |
| Pioneer Trail | 71.71 | January 1959 | 3,750 | 0 |
| | | Intermediate Regional | 5,050 | 1.2 |
| | | Standard Project | 18,300 | 10.0 |
| Ohio State Route 82 | 72.64 | January 1959 | 3,700 | 0 |
| | | Intermediate Regional | 5,000 | 1.4 |
| | | Standard Project | 18,300 | 10.8 |
| U.S.G.S. Gaging Station (Winchell Road) | 75.80 | January 1959 | 3,670 | 0 |
| | | Intermediate Regional | 4,900 | 1.7 |
| | | Standard Project | 18,300 | 10.2 |
| Portage County Line | 76.32 | January 1959 | 3,670 | 0 |
| | | Intermediate Regional | 4,900 | 1.6 |
| | | Standard Project | 18,300 | 10.1 |

be enacted and enforced to protect other people from unwisely developing in flood hazard areas. The Tri-County Regional Planning Commission can assist in the drafting of flood plain legislation.

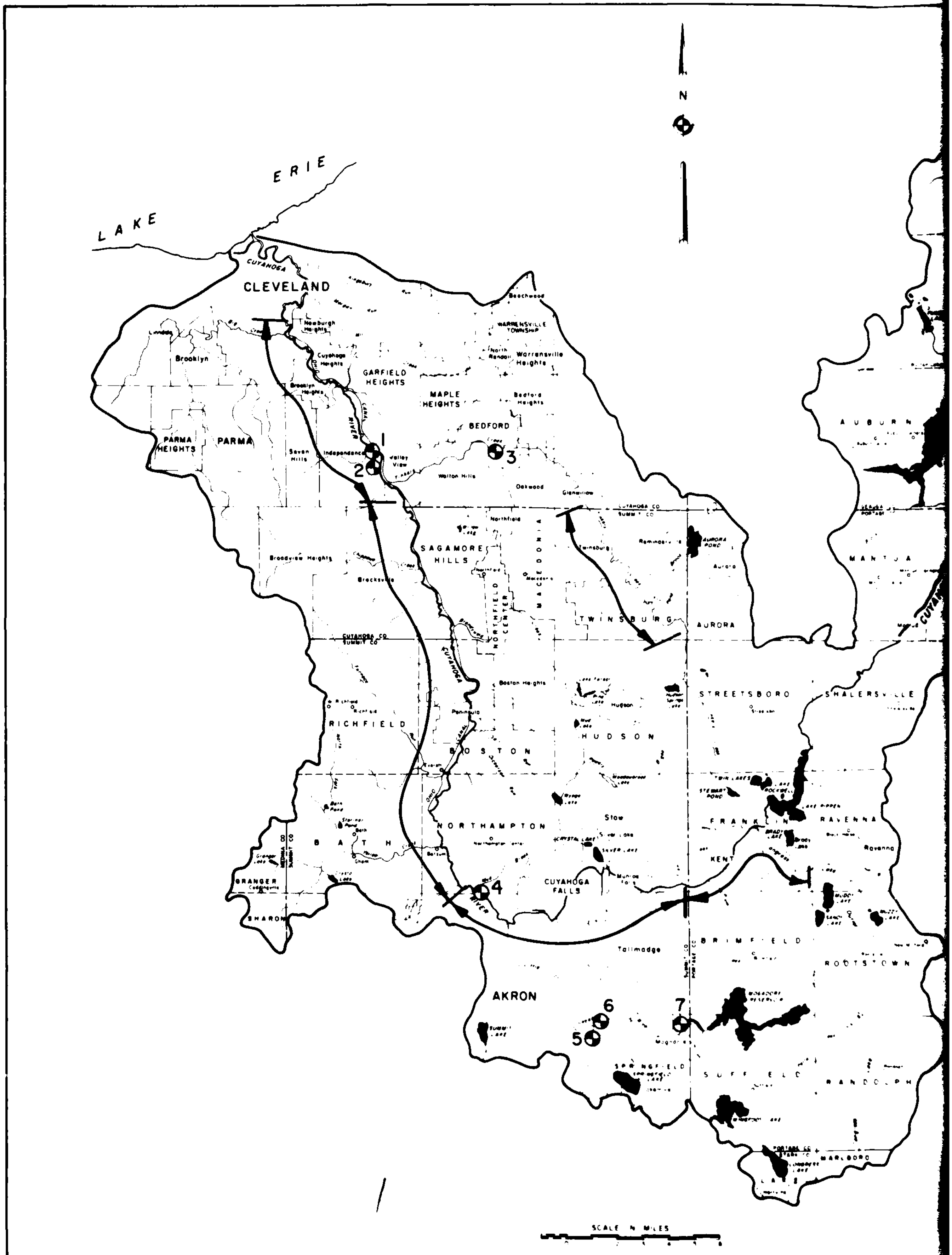
Runoff from the upper Cuyahoga River basin above this study area is modified by two main reservoirs. These reservoirs, shown on plate 1, serve dual purposes: domestic and industrial water supply and flood control. They have been partially financed with Federal funds. The two reservoirs are:

(a) East Branch Reservoir - is located north of Burton on the Cuyahoga River and regulates river flow to Lake Rockwell Reservoir, the principal water supply reservoir of the City of Akron. The federal share of total costs was $258,000. The reservoir impounds about 4,600 acre-feet of water and subtends a drainage area of about 18 square miles.

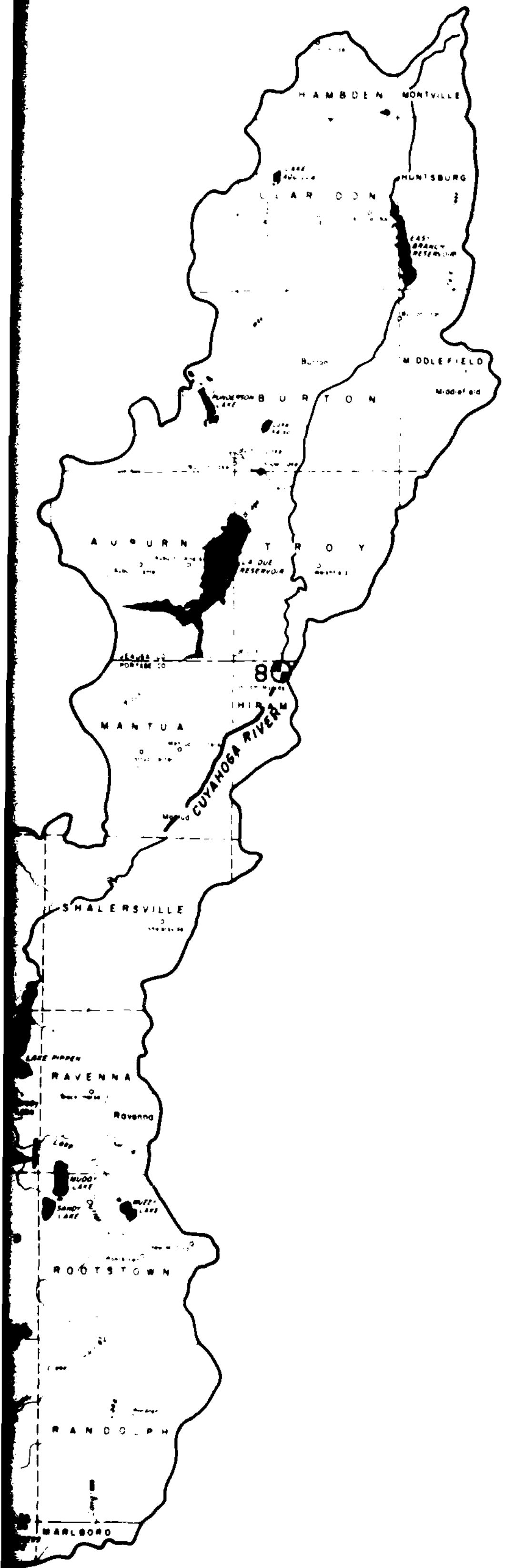
(b) LaDue Reservoir - is located just north of Hiram Rapids and controls about 30 square miles of drainage area. This reservoir was also constructed by the City of Akron for water supply.

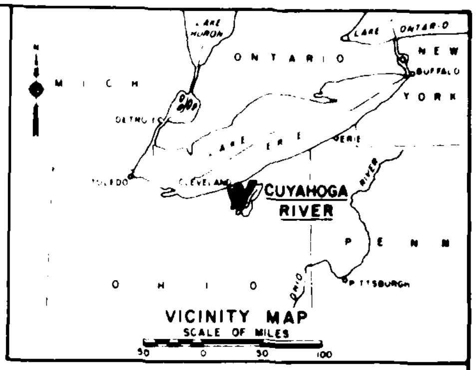
POSSIBLE FLOOD HEIGHTS - Flood levels that would be reached by the Intermediate Regional and Standard Project Floods are shown on table 1. The table compares these flood crests with the January 1959 flood at selected sites along the Cuyahoga River. The water surface profile for the January 1959 flood, the Intermediate Regional Flood, and the Standard Project Flood are shown on plates 7 and 8.

VELOCITIES OF WATER - Estimated average channel velocities of the Cuyahoga River during a major flood such as January 1959 would vary from approximately 2 to 7 feet per second. Velocities in the overbank areas would be normally less than one foot per second. These overbank velocities are not considered dangerous against structures.



N
LAKE ERIE
CUYAHOGA
CLEVELAND
Brooklyn
PARMA HEIGHTS
PARMA
GARFIELD HEIGHTS
MAPLE HEIGHTS
BEDFORD
Warrensville Heights
Independence
Valley View
Walton Hills
Oakwood
SAGAMORE HILLS
Broadview Heights
Brecksville
NORTHFIELD CENTER
MACEDONIA
TWINSBURG
AURORA
AUBURN
MANTUA
STREETSBORO
SHALERSVILLE
Boston Heights
RICHFIELD
BOSTON
HUDSON
NORTHAMPTON
BATH
GRANGER
SHARON
Stow
CUYAHOGA FALLS
FRANKLIN
RAVENNA
Ravenna
KENT
Tallmadge
BRIMFIELD
ROOTSTOWN
AKRON
SPRINGFIELD
SUFFIELD
RANDOLPH
MARLBORO
1
2
3
4
5
6
7
SCALE IN MILES

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AUTHORIZED AND COMPLETED FLOOD PLAIN INFORMATION STUDIES WITHIN THE CUYAHOGA RIVER BASIN

U.S.G.S. WATER-STAGE RECORDING GAGE

1 CUYAHOGA RIVER AT INDEPENDENCE

2 OHIO CANAL AT INDEPENDENCE

3 TINKERS CREEK AT BEDFORD

4 CUYAHOGA RIVER AT OLD PORTAGE

5 SPRINGFIELD LAKE OUTLET AT AKRON

6 LITTLE CUYAHOGA RIVER AT MASSILLON ROAD, AKRON

7 LITTLE CUYAHOGA RIVER AT MOGADORE

8 CUYAHOGA RIVER AT HIRAM RAPIDS

CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT

**BASIN MAP**

U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972

Velocities of an Intermediate Regional Flood and Standard Project Flood would be somewhat higher. The velocities for these two floods at selected locations are given in the "Future Floods" section of this report. Velocities are normally considered hazardous to life and property when the depth is greater than three feet and the speed exceeds three feet per second.

HAZARDOUS CONDITIONS - Past floods have caused numerous hazards to local residents. Since many of the past floods have occurred in late winter or early spring, residents may suffer illness and discomfort from lack of heat for a number of days if basement flooding extinguishes furnace fires. In a flood, health problems frequently develop when septic tanks and municipal sewage treatment facilities are taxed beyond their capabilities. Flood waters overtop roads and cause hazardous driving conditions. The amount of damage caused by any flood depends upon the type and extent of development, how much area is flooded, the depth of flooding, the duration of flooding, and the velocity of flow.

Exhibit 1 - STATE ROUTE 44 AT SOUTH EDGE OF MANTUA LOOKING NORTH

## GENERAL CONDITIONS AND PAST FLOODS

GENERAL - This section of the report is a history of past floods on the Cuyahoga River in the study area.

THE STREAM AND ITS VALLEY - The Cuyahoga River drains a "U" shaped basin approximately 809 square miles in northeastern Ohio. The basin shown on plate I includes parts of Cuyahoga, Geauga, Medina, Portage, Stark and Summit Counties. The river rises about ten miles northeast of Burton, Geauga County, and flows in a southerly direction to near the village of Hiram Rapids, then southwesterly and westerly, passing through Mantua, Kent, and Cuyahoga Falls to its confluence with the Little Cuyahoga River at Akron, thence northerly to Lake Erie at Cleveland. The total drainage area upstream of the U.S.G.S. gage at Hiram Rapids is 151 square miles, or about 19% of the total Cuyahoga River drainage area. The main tributaries of the river are: Big, Mill, Tinkers, Yellow, Brandywine, and Chippewa Creeks, Mud Brook, Furnace Run, Little Cuyahoga River, Breakneck Creek (Congress Lake Outlet) and West Branch Cuyahoga River.

The watershed consists of rolling hills except for the gently sloping area about three miles wide bordering Lake Erie. The Cuyahoga River rises at about elevation 1,300 feet above mean sea level and discharges into Lake Erie at about elevation 570.0. Upstream of Cuyahoga Falls, the Cuyahoga River cuts through glacial drift and is relatively flat with a fall of about four feet per mile. At Cuyahoga Falls the river cuts through Pennsylvania sandstone and drops 220 feet in 1.5 miles. In the lower northward course, the river flows in a pre-glacial valley with a fall of about five feet per mile. In the reach between the mouth of Tinkers Creek and the head of navigation in Cleveland, the channel falls 25 feet in 10 miles. Most of the residential, commercial, and industrial development in the study area is located on ground lying above the flood plain.

Various channel conditions in the study area are shown on figures 4 through 8. Table 2 shows various drainage areas within the Cuyahoga River basin.

STREAM GAGING RECORDS - Presently there are eight gaging stations in the Cuyahoga River basin maintained by the U. S. Geological Survey. The Cuyahoga River gage at Hiram Rapids is the only one in the reach covered by this report. The Hiram Rapids gage is located just downstream of Winchell Road. The total drainage area upstream of the gage site is 151 square miles. The first record of stages and discharges on Cuyahoga River at Hiram Rapids began in August 1927. Annual reports published by the United States Geological Survey furnish the average daily discharges in cubic feet per second, the maximum and minimum instantaneous discharges, and the maximum and minimum water stages. An annual publication "Water Resources for Ohio, Part I" is available from the U. S. Geological Survey office in Columbus, Ohio. In recent years, several of the continuous water-stage recorders that produce a graphic representation of the rise and fall of the water surface with respect to time have been replaced by digital-type recorders. A digital-type recorder punches onto a paper tape the stage at a selected time interval permitting the direct computerization of stream flow data. The time interval at which the stage is punched onto the tape is selected such that a stage hydrograph (See Glossary) can be adequately defined. The U. S. Geological Survey also maintains staff gages. A staff gage, a graduated scale anchored vertically on the stream bank, provides a visual determination of the water surface at any given time.

Pertinent drainage areas of the Cuyahoga River and its tributaries are given in table 2.

TABLE 2

DRAINAGE AREAS WITHIN THE CUYAHOGA RIVER BASIN

| Location on Cuyahoga River | Drainage Area Upstream of Location (square miles) |
|---|---|
| Mouth | 809 |
| Big Creek junction | 749 |
| Mill Creek junction | 710 |
| Independence Gage | 707 |
| Tinkers Creek junction | 597 |
| Chippewa Creek junction | 565 |
| Brandywine Creek junction | 528 |
| Furnace Run junction | 480 |
| Yellow Creek junction | 443 |
| Mud Brook junction | 433 |
| Old Portage Gage | 404 |
| Little Cuyahoga River junction | 340 |
| Breakneck Creek junction | 211 |
| Hiram Rapids Gage | 151 |
| West Branch Cuyahoga River junction | 41.4 |

## SETTLEMENT

HIRAM - The original Hiram Township was purchased from the Connecticut Land Company by a group of nine men. Of these men, Daniel Tilden was probably the only one to visit the land. The first settlers of Hiram are thought to have arrived about 1800. Hirams most distinguished son was James A. Garfield, Twentieth President of the United States.

MANTUA - Abraham Honey is thought to have built the first settlement in Mantua. His log cabin was constructed in 1798 at the foot of Derthick Hill near the Cuyahoga River. The first bridge was built in 1804 by Rufus Edwards at a cost of $100.00. In 1810, Mantua had a population of 234 and in 1970, 1,199 in the village and 4,051 in the Township.

POPULATION - Figure 1 illustrates the population trends for the individual communities in the study area. Since 1950 the population of the communities in the study area has increased 29 percent.

DEVELOPMENT IN FLOOD PLAIN - The location of the study area relative to the Cuyahoga River basin is shown on the basin map on plate 1. Although the study area is relatively undeveloped at the present time, population trends indicate that the area will become more developed in the future largely because of the expansion of the Akron metropolitan area. There are several commercial and industrial buildings located near the channel in Mantua Village. It is imperative that flood plain regulations be adopted now so that future development will not be on lands that have been flooded in the past or may flood in the future.

EXISTING REGULATIONS - There are no flood plain regulations in the study area. However, flood plain regulations could control development within the flood plain while making the most effective use of land with respect to flood risk. Such regulations may be made possible by counties, municipalities, and townships under their regular zoning

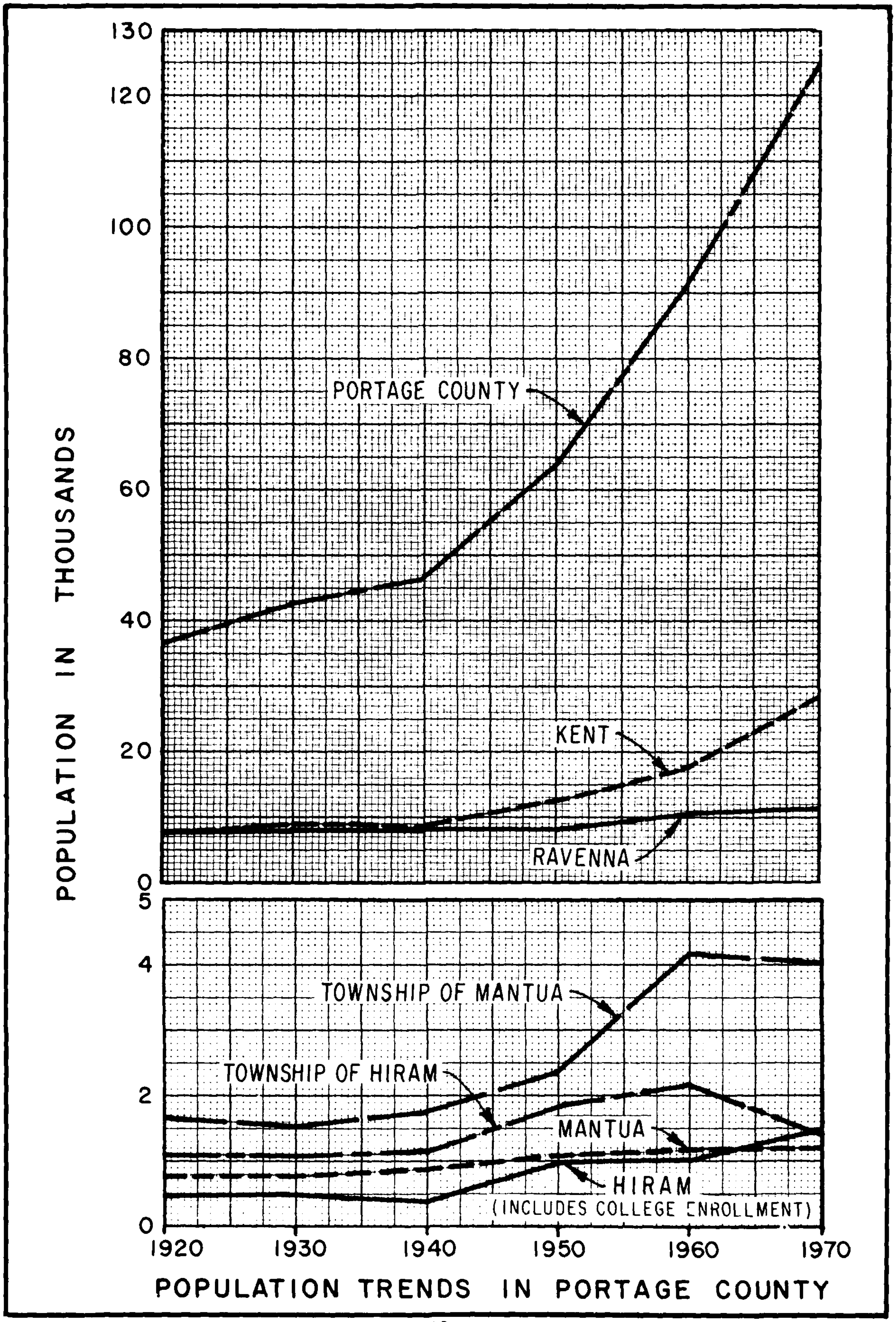

130
120
100
80
60
40
20
0
5
4
2
0
POPULATION IN THOUSANDS
PORTAGE COUNTY
KENT
RAVENNA
TOWNSHIP OF MANTUA
TOWNSHIP OF HIRAM
MANTUA
HIRAM
(INCLUDES COLLEGE ENROLLMENT)
1920
1930
1940
1950
1960
1970
POPULATION TRENDS IN PORTAGE COUNTY

FIGURE I

and building codes statutes. Samples of flood plain regulations passed in communities throughout the country are available at the Buffalo District office.

This report provides local governments with information on which to base their regulations.

In the State of Ohio, the power to adopt and enforce zoning regulations is delegated to political subdivisions. The enabling statutes are sections 303.02, 519.02 and 713.07 of the revised code. The General Assembly of the State of Ohio has passed an amendment to House Bill No. 314 that states all department and agencies of the State shall notify and furnish information to the Division of Water on State facilities which may be affected by flooding. This information is required in order to avoid the uneconomical, hazardous, or unnecessary use of flood plains in connection with State facilities. The amendment further reads that where economically feasible, departments and agencies of the State and political subdivisions responsible for existing publicly owned facilities shall apply flood proofing measures in order to reduce potential flood damage. Under Executive Order 11296, the Federal Government has similar restrictions in that all executive agencies directly responsible for the construction of Federal facilities shall evaluate flood hazards when planning the location of new facilities. In addition, this order requires that executive agencies responsible for the administration of Federal grant, loan or mortgage insurance programs shall evaluate flood hazards in order to minimize potential flood damage and the need for future Federal expenditures for flood protection and flood disaster relief.

FLOOD WARNING AND FORECASTING SERVICES - The study area is well within the effective range of the Weather Surveillance Radar which is operated continuously by the National Weather Service at the

Cleveland Airport and the Akron-Canton Airport. This equipment provides for the early detection and plotting of heavy precipitation and makes possible immediate radio and television broadcasts of information concerning the predicted path and amount of rainfall from the storm.

BRIDGES - There are 7 highway bridges, one foot bridge, and one railroad bridge in the reach covered by this study. Table 3 lists pertinent data for these structures and shows the relationship of the Intermediate Regional Flood and the Standard Project Flood to the January 1959 flood.

Water surface profiles shown on plates 7 and 8 should be helpful to local officials in any future construction of new bridges or alterations of existing bridges. At any new bridge there should be sufficient clearance for drift and debris which usually accompany high water. On figures 2 through 9 are photographs of the bridges.

DAM - There is one dam on the Cuyahoga River in the study area at stream mile 74.72. Figure 10 is a photograph of this dam.

OBSTRUCTIONS TO FLOOD FLOWS - Inadequate bridge areas, abandoned dams, encroachments, and fills are some of the obstructions to flood flows. Other serious obstructions are bends in the stream, irregularity of channel section, and heavy brush, weeds, and large trees growing on the channel banks and extending into the stream. Figures 11 and 12 show typical obstruction in the study area, which tend to reduce floodway capacity and increase river stages. Figures 13 and 14 show channel sections in the study area which are fairly free of obstructions. However, both of these photos show a heavy brush growth in the overbank areas which would tend to restrict flow during floods.

To keep obstructions to flows at a minimum, each community should establish maintenance programs for stream within their area. For example, highway crews during slack periods could remove fallen trees, shoals, and debris that may have collected in the channel.

TABLE 3

BRIDGES ACROSS CUYAHOGA RIVER

| Mile Above Mouth | Identification | Stream Bed Elev. | Low Steel Elev. | Floor Elev. (2) | Standard Project Crest Elev. (1) | Intermediate Regional Flood Crest Elev. (1) | January 1959 Flood Crest Elev. (1) |
|---|---|---|---|---|---|---|---|
| 69.25 | Gravel Road | 1069.4 | 1079.3 | 1081.7 | 1091.2 | 1084.7 | 1083.5 |
| 69.40 | Ohio State Route 44 | 1072.5 | 1081.9 | 1084.6 | 1091.8 | 1085.1 | 1084.1 |
| 69.92 | Erie-Lackawanna Railway | 1070.2 | 1097.7 | 1107.3 (3) | 1094.0 | 1085.7 | 1084.3 |
| 70.19 | Mennonite Road | 1076.2 | 1085.3 | 1087.6 | 1096.1 | 1087.1 | 1086.1 |
| 71.71 | Pioneer Trail | 1078.4 | 1089.9 | 1091.5 | 1098.4 | 1089.7 | 1088.5 |
| 72.63 | Ohio State Route 82 | 1080.0 | 1094.9 | 1099.3 | 1101.0 | 1091.7 | 1090.4 |
| 75.63 | Allyn Road | 1085.4 | 1097.9 | 1100.0 | 1105.8 | 1096.8 | 1095.2 |
| 75.80 | Winchell Road | 1086.7 | 1098.7 | 1101.2 | 1106.6 | 1097.9 | 1096.3 |

(1) All elevations referred to upstream side of respective bridges.
(2) All floor elevations are referred to centerline of street except where top of rail is given.
(3) Top of rail elevation.

A concentrated effort should be made by the people not to throw refuse or other matter into the streams. The local government should establish a floodway, a strip of land on either side of the river that is kept free of obstructions to flows. Flood flows have come in the past and they will come again. A floodway provides extra room when high water comes.

Exhibit 2 - STATE ROUTE 44 AT SOUTH EDGE OF MANTUA LOOKING NORTH

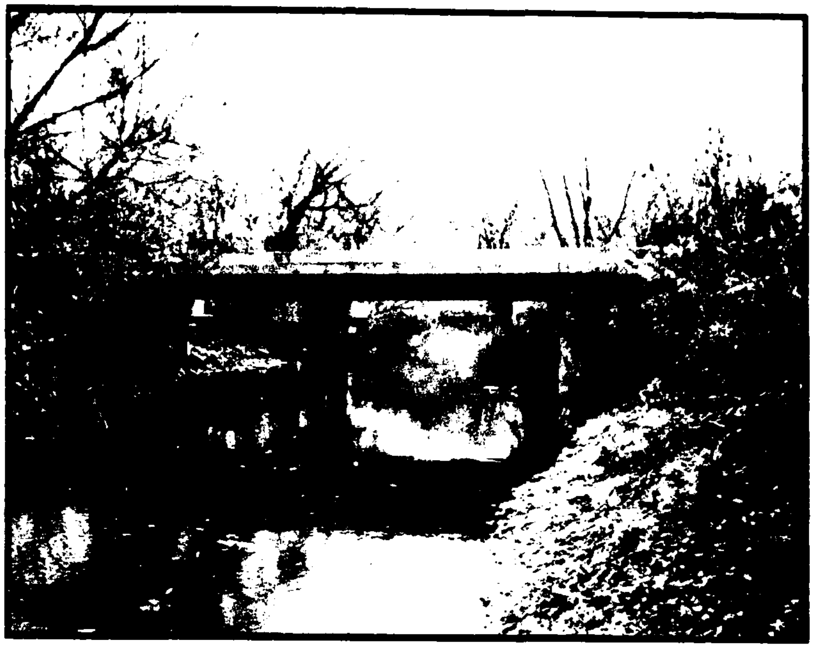


Figure 2 - Looking downstream at Gravel Road bridge, stream mile 69.25.

Figure 3 - Looking upstream at Ohio State Route 44 bridge, stream mile 69.40.

Typical bridges
Photos were taken in November 1971

Figure 4 - Looking downstream at Erie - Lackawanna Railway bridge, stream mile 69.92.

Figure 5 - Looking upstream at Mennonite Road bridge, stream mile 70.19.

Typical bridges
Photos were taken in November 1971

Figure 6 - Looking upstream at Pioneer Trail bridge, stream mile 71.71.

Figure 7 - Looking upstream at Ohio State Route 82 bridge, stream mile 72.63.

Typical bridges
Photos were taken in November 1971

Figure 8 - Looking upstream at Allyn Road bridge, stream mile 75.63.

Figure 9 - Looking upstream at Winchell Road bridge, stream mile 75.80.

Typical bridges
Photos were taken in November 1971

Figure 10 - Looking upstream at the dam at stream mile 74.72.

Figure 11 - Typical obstruction in the study area, stream mile 69.40.

Photos were taken in November 1971

Figure 12 - Typical obstruction in the study area, stream mile 74.72.

Figure 13 - Typical clean channel section in study area, stream mile 69.25.

Photos were taken in November 1971

Figure 14 - Typical clean channel section in study area, stream mile 69.25.

Photo was taken in November 1971

## FLOOD SITUATION

FLOOD STAGES AND DISCHARGES - Table 4 lists flood crests and peak discharges for the known floods exceeding bankfull stage of 2.84 feet at the Hiram Rapids gage. A discharge of approximately 450 cfs will produce a stage of 2.84 feet at the gage.

Plate 2 shows known crest stages and years of occurrence of floods since 1927 which have exceeded the bankfull stage of 2.84 feet at the gage. Table 5 lists the ten highest discharges recorded at the Hiram Rapids gage in order of magnitude.

Exhibit 3 - FLOODING AT WELLS TRUCK LINES

TABLE 4

KNOWN FLOODS AT HIRAM RAPIDS, OHIO

The table includes all known floods above bankfull stage of 2.84 feet at the U. S. Geological Survey station just downstream from the highway bridge at Winchell Road, Hiram Rapids, Ohio, stream mile 75.80. Drainage area = 151 square miles. Zero of gage = 1087.46 feet U.S.C.& G.S. datum (unadjusted). Top of bank at the gage site is at 1090.30 feet.

Gage Heights

| Date of Crest | Stage feet (1) | Discharge c.f.s. | Elevation feet (1) |
|---|---|---|---|
| 15 December 1927 | 5.30 | 1,630 | 1092.76 |
| 20 January 1929 | 6.26 | 2,260 | 1093.72 |
| 14 January 1930 | 5.43 | 1,710 | 1092.89 |
| 5 April 1931 | 3.40 | 689 | 1090.86 |
| 25 March 1932 | 3.61 | 795 | 1091.07 |
| 16 March 1933 | 4.84 | 1,360 | 1092.30 |
| 7 March 1934 | 5.27 | 1,620 | 1092.73 |
| 17 March 1935 | 4.13 | 1,000 (2) | 1091.59 |
| 24 February 1945 | 5.06 | 1,480 | 1092.52 |
| 8 January 1946 | 4.27 | 1,060 | 1091.73 |
| 3 April 1947 | 5.40 | 1,690 | 1092.86 |
| 23 March 1948 | 6.94 | 2,760 | 1094.40 |
| 29 January 1949 | 3.61 | 790 | 1091.07 |
| 15 February 1950 | 6.13 | 2,170 | 1093.59 |
| 5 January 1951 | 5.85 | 1,980 | 1093.31 |
| 27 January 1952 | 6.44 | 2,380 | 1093.90 |
| 21 January 1953 | 2.95 | 474 | 1090.41 |
| 27 March 1954 | 4.65 | 1,260 | 1092.11 |
| 17 March 1954 | 5.85 | 1,980 | 1093.31 |
| 9 March 1956 | 5.66 | 1,860 | 1093.12 |
| 26 April 1957 | 6.13 | 2,170 | 1093.59 |
| 1 March 1958 | 4.77 | 1,320 | 1092.23 |
| 23 January 1959 | 8.11 | 3,670 | 1095.57 |
| 31 March 1960 | 6.58 | 2,490 | 1094.04 |
| 26 April 1961 | 5.82 | 1,950 | 1093.28 |
| 24 March 1962 | 3.45 | 710 | 1090.91 |
| 19 March 1962 | 6.83 | 2,670 | 1094.29 |
| 6 March 1964 | 6.57 | 2,480 | 1094.03 |

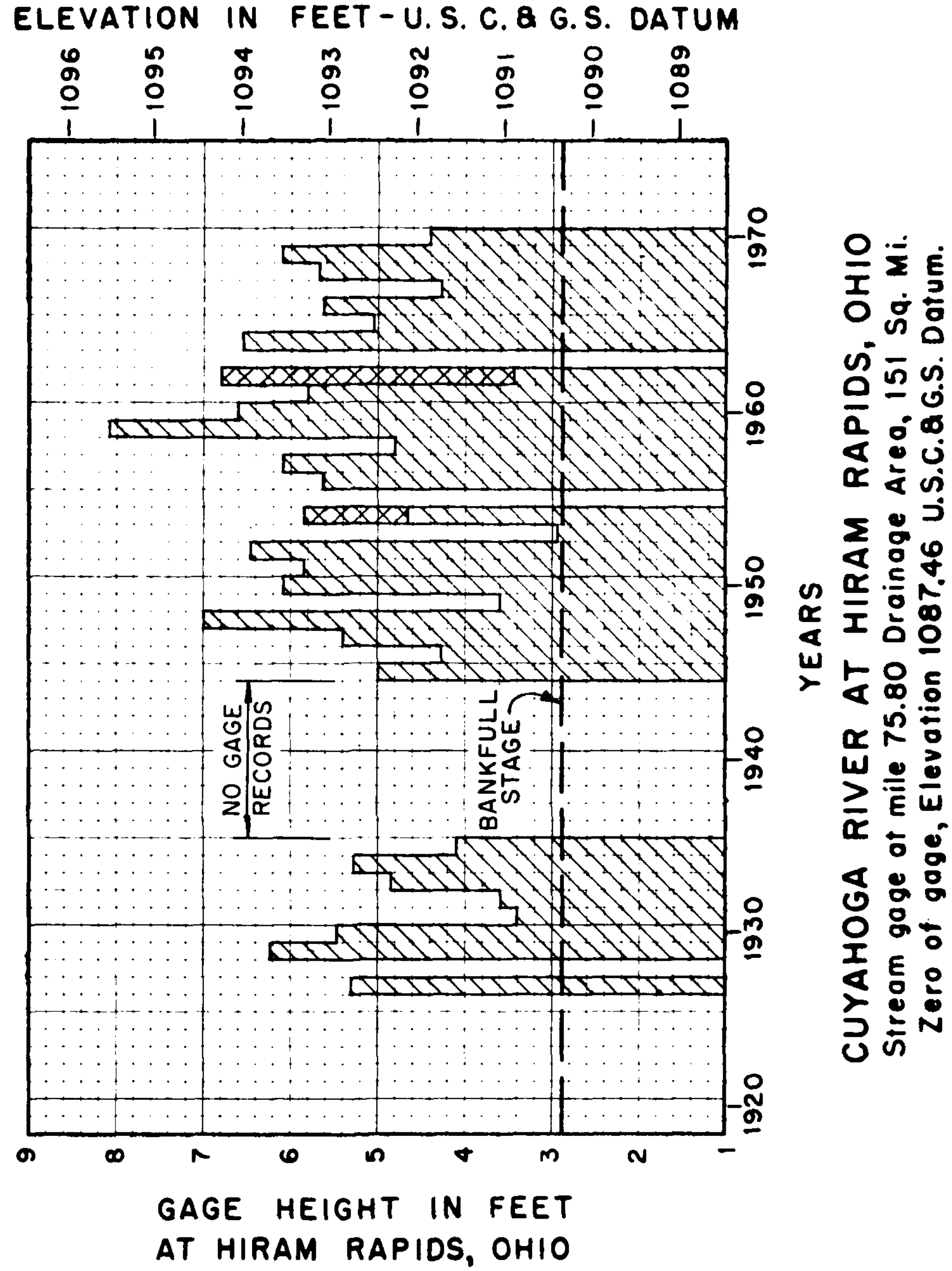
TABLE 4 (Cont'd)

Gage Heights

| Date of Crest | Stage feet (1) | Discharge c.f.s. | Elevation feet (1) |
|---|---|---|---|
| 28 January 1965 | 5.05 | 1,470 | 1092.51 |
| 13 February 1966 | 5.62 | 1,820 | 1093.08 |
| 13 May 1967 | 4.30 | 1,080 | 1091.76 |
| 3 February 1968 | 5.71 | 1,880 | 1093.17 |
| 30 December 1969 | 6.07 | 2,130 | 1093.53 |
| 6 March 1970 | 4.43 | 1,140 | 1091.89 |

(1) Stages and elevations are based on existing stage-discharge relationships.
(2) Estimated (U.S.G.S.)

Exhibit 4 - STATE ROUTE 44 AT SOUTH EDGE OF MANTUA LOOKING NORTH




**NOTE:**

Variation in shading on the bar graph indicates more than one flood during the year.

CUYAHOGA RIVER
MANTUA AND HIRAM
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FLOOD PLAIN INFORMATION REPORT

FLOODS ABOVE
BANKFULL STAGE

U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972

PLATE 2

## TABLE 5

### HIGHEST TEN KNOWN FLOODS IN ORDER OF MAGNITUDE CUYAHOGA RIVER AT U.S.G.S. GAGING STATION HIRAM RAPIDS, OHIO

| Order No. | Date of Crest | Stage feet (1) | Elevation feet (1) | Estimated Peak Discharge c.f.s. |
|---|---|---|---|---|
| 1 | 23 January 1959 | 8.11 | 1095.57 | 3,670 |
| 2 | 23 March 1948 | 6.94 | 1094.40 | 2,760 |
| 3 | 19 March 1962 | 6.83 | 1094.29 | 2,670 |
| 4 | 31 March 1960 | 6.58 | 1094.04 | 2,490 |
| 5 | 6 March 1964 | 6.57 | 1094.03 | 2,480 |
| 6 | 27 January 1952 | 6.44 | 1093.90 | 2,380 |
| 7 | 20 January 1929 | 6.26 | 1093.72 | 2,260 |
| 8 | 15 February 1950 | 6.13 | 1093.59 | 2,170 |
| 9 | 26 April 1957 | 6.13 | 1093.59 | 2,170 |
| 10 | 30 December 1969 | 6.07 | 1093.53 | 2,130 |

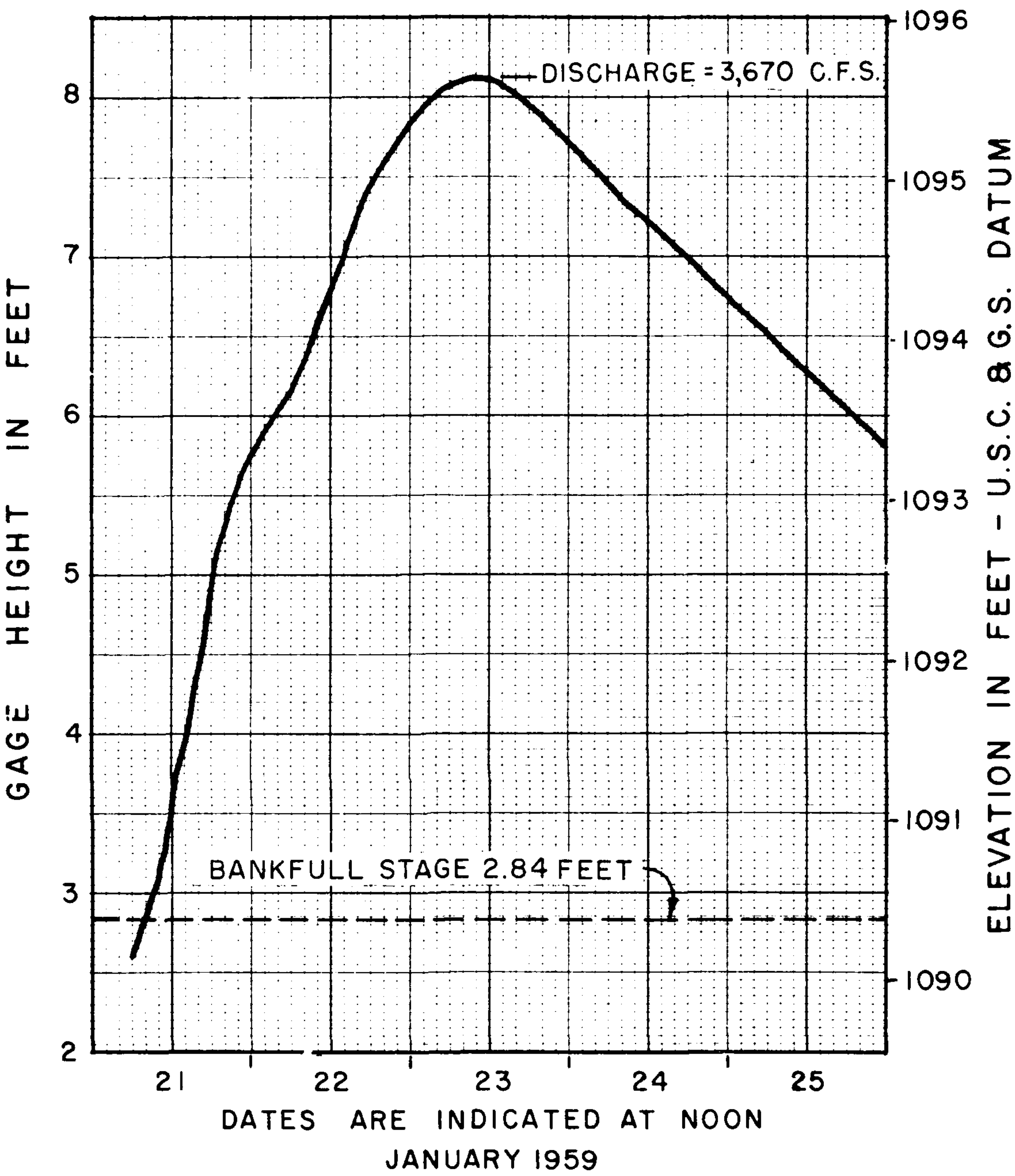
(1) Based on existing stage-discharge relationship.

DURATION AND RATE OF RISE - Plate 3 shows the stage hydrograph of the January 1959 flood at the U.S.G.S. gaging station on the Cuyahoga River at Hiram Rapids. At the gage site during this flood the river rose to its crest in 50 hours at an average rate of rise of 0.11 foot per hour with a maximum rate of 1 foot in 3 hours and remained above bankfull (flood) stage for about 148 hours.

VELOCITIES - During the January 1959 flood the average channel velocity was approximately two to five feet per second. Overbank velocities ranged up to 1.5 feet per second.

FLOODED AREAS, FLOOD PROFILES AND CROSS SECTIONS - Plates 5 and 6 show the approximate areas along the Cuyahoga River that would be inundated by the Intermediate Regional Flood and the Standard Project Flood. The approximate flood elevations of these floods are shown on plates 7 and 8. Typical valley cross sections in the study area are shown on plates 9 and 10.

Exhibit 5 - FLOODING IN MANTUA PARK PLAYGROUNDS




HIRAM RAPIDS, OHIO

NOTES:

GAGE IS A WATER-STAGE RECORDER AND IS LOCATED AT STREAM MILE 75.8. THE ZERO OF THE GAGE EQUALS ELEVATION 1087.46 U.S.C. & G.S. DATUM (UNADJUSTED).

DRAINAGE AREA EQUALS 151 SQUARE MILES.

STAGES AFFECTED BY ICE FROM JAN. 16 TO 22 AND JAN. 25 TO FEB. 11, 1959. GAGE WELL WAS FROZEN FROM JAN. 24 TO 27, 1959. RECORD FOR THIS PERIOD BASED ON ONCE DAILY WIRE-WEIGHT GAGE READING.

BANKFULL STAGES DOES NOT NECESSARILY INDICATE INITIAL DAMAGING CONDITIONS.

CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT

STAGE HYDROGRAPH

U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972

FLOOD DESCRIPTIONS

Descriptions of storms that have caused flooding in the Cuyahoga River basin are based upon field investigations, historical records and newspaper accounts. The greatest flood of historical record occurred in March 1913. A condensation of available information on these flood occurrences is given in the following paragraphs. This information is presented as an example of the type and extent of flood problems which have already occurred in the basin and an indication of possible future flood problems.

23-26 MARCH 1913 - The storm which caused the greatest flood of historical record in the Cuyahoga River basin developed from the stagnation of a tropical marine air mass from the Gulf of Mexico against a cold air mass from Canada. Heavy rains occurred during the periods 13-15 and 20-21 March. These rains were only preliminary to a severe storm which developed during the period of 23-26 March. This storm extended from Texas to Lake Erie with its center over Bellefontaine, Ohio, 125 miles southwest of the Cuyahoga basin. Two low-pressure centers continued to form a long trough of low pressure which caused excessive rainfall in Ohio and neighboring states for about 60 hours. A record total of 11.16 inches of rainfall fell in Bellefontaine in 92 hours. Along the northeast edge of the storm the Cuyahoga basin received an average of 9.65 inches of rainfall in a 96-hour period. On 23 March, 1.85 inches fell; on 24 March, 4.75 inches fell; on 25 March, 1.89 inches fell; on 26 March, 1.16 inches fell. Because of four days of rain, the Cuyahoga River overtopped its banks and brought death and disaster to much of the valley. Big Reservoir in the Portage Lakes district gave way with millions of gallons of water pouring down the Ohio Canal. The Cuyahoga River was transformed into a rage sweeping everything before it. Information on this flood through Mantua and Hiram is not available.

25-26 JANUARY 1952 - Heavy rain occurred on 25-26 January 1952 over most of Ohio and caused many rivers to go on a rampage. At the Akron-Canton Airport Weather Station, 2.00 inches of rain fell in a 30-hour period over these two days. The maximum rainfall was 0.59 inch in a 3-hour period on 26 January. The severe storm on the 25th and 26th gave record breaking 24-hour precipitation measurements in many areas of Ohio. This storm produced the sixth highest stage ever recorded at the Hiram Rapids gage.

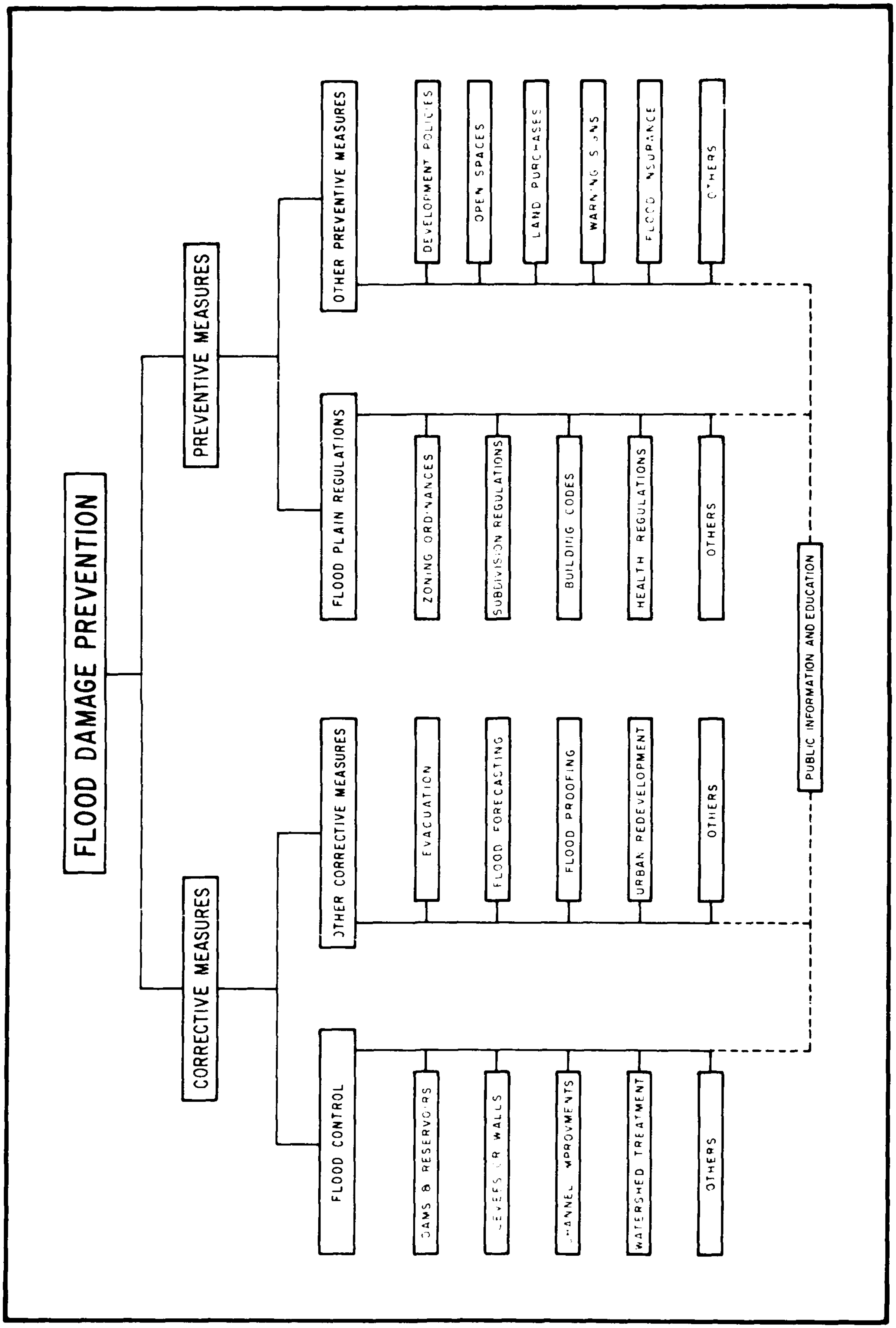
20-21 JANUARY 1959 - A storm developed from a large mass of cold air over northwestern Canada, a flow of warmer air from the southwest and the associated frontal system. Heavy rains began when the moisture-laden air from the south and the cold front converged. The storm was centered approximately 150 miles southwest of the Cuyahoga River basin. High water caused by two days of rain on 20-21 January 1959 inflicted damage in not only parts of Portage County but throughout the State of Ohio. More rain than usually falls in the whole month of January was dumped on the Akron area on these two days causing widespread damage to homes and highways. Some families were forced to evacuate their homes by boat. During January 1959 temperatures were several degrees below normal. When the temperatures reached $-5^{o}$ on the 18th, the ground became frozen. At the Akron Sewage Works, 2.86 inches of rain fell during a 30-hour period on 20-21 January. In a 3-hour period on 21 January, 0.82 inch of rain fell. Although total rainfall for the storm was not excessive, intensities were high and runoff was increased by the frozen ground and the 6-inch snow cover on the basin. Following the rainfall, there was a warming trend which contributed snow melt. Rainfall averaged 2.34 inches over the entire basin; runoff from rainfall and snow melt averaged 2.94 inches. At the Hiram Rapids gage the January 1959 flood reached elevation 1095.57, U.S.C. & G.S. datum, which is approximately 5.3 feet above bankfull stage.

This concludes the "General Conditions and Past Floods" section of this report. What can be done to prevent and/or reduce future flood

damages? FLOOD PLAIN MANAGEMENT provides the solution! Wise flood plain management can control the use of the flood plain as a means of reducing damage caused by future flooding.

By using the flooded area maps, profiles and cross sections contained in this report as a guide, limited urban development can be allowed in the flood plain depending on the frequency of flooding. The elevations shown on the profiles should be used to determine flood heights because they are more accurate than the flooded outlines. Units of low damage construction should be stressed during future development in areas which are susceptible to frequent flooding. If it is uneconomical to elevate these lands, a means of flood proofing the structures should be given careful consideration.

As soon as possible, local governments should develop and enforce flood plain regulations based on the information contained in this report. This report provides local governments with the necessary tools to control the extent and type of development which should be allowed to take place within the flood plain. Regulation of the flood plain can usually be carried out most effectively by a combination of the several regulatory methods ... zoning ordinances, subdivision regulations and building codes. Local governments can also police and maintain the floodway so as to insure against the overgrowth of brush, weeds, debris and large trees which obstruct flood flows. All of these factors result in increased river stages. The U. S. Army Corps of Engineers has prepared and is distributing to State, county and local governments for public dissemination two pamphlets, "Guidelines for Reducing Flood Damages" and "Introduction to Flood Proofing." The combination of data presented in this report and in the pamphlets will provide general guidelines for flood damage reduction in future development within the Cuyahoga River flood plain. Figure 15 lists the corrective and preventive measures described in the above mentioned pamphlets. The U. S. Army Corps of Engineers will distribute to State, county and local governments other helpful pamphlets as well as additions to existing pamphlets when they are developed. Figure 16 indicates the ideal development of a flood plain.



FLOOD DAMAGE PREVENTION
CORRECTIVE MEASURES
PREVENTIVE MEASURES
FLOOD CONTROL
OTHER CORRECTIVE MEASURES
FLOOD PLAIN REGULATIONS
OTHER PREVENTIVE MEASURES
DAMS & RESERVOIRS
LEVEES OR WALLS
CHANNEL IMPROVEMENTS
WATERSHED TREATMENT
OTHERS
EVACUATION
FLOOD FORECASTING
FLOOD PROOFING
URBAN REDEVELOPMENT
OTHERS
ZONING ORDINANCES
SUBDIVISION REGULATIONS
BUILDING CODES
HEALTH REGULATIONS
OTHERS
DEVELOPMENT POLICIES
OPEN SPACES
LAND PURCHASES
WARNING SIGNS
FLOOD INSURANCE
OTHERS
PUBLIC INFORMATION AND EDUCATION


FIGURE 15

# Flood plain regulations

## TO ENCOURAGE WISE USE AND AVOID FLOOD DAMAGE

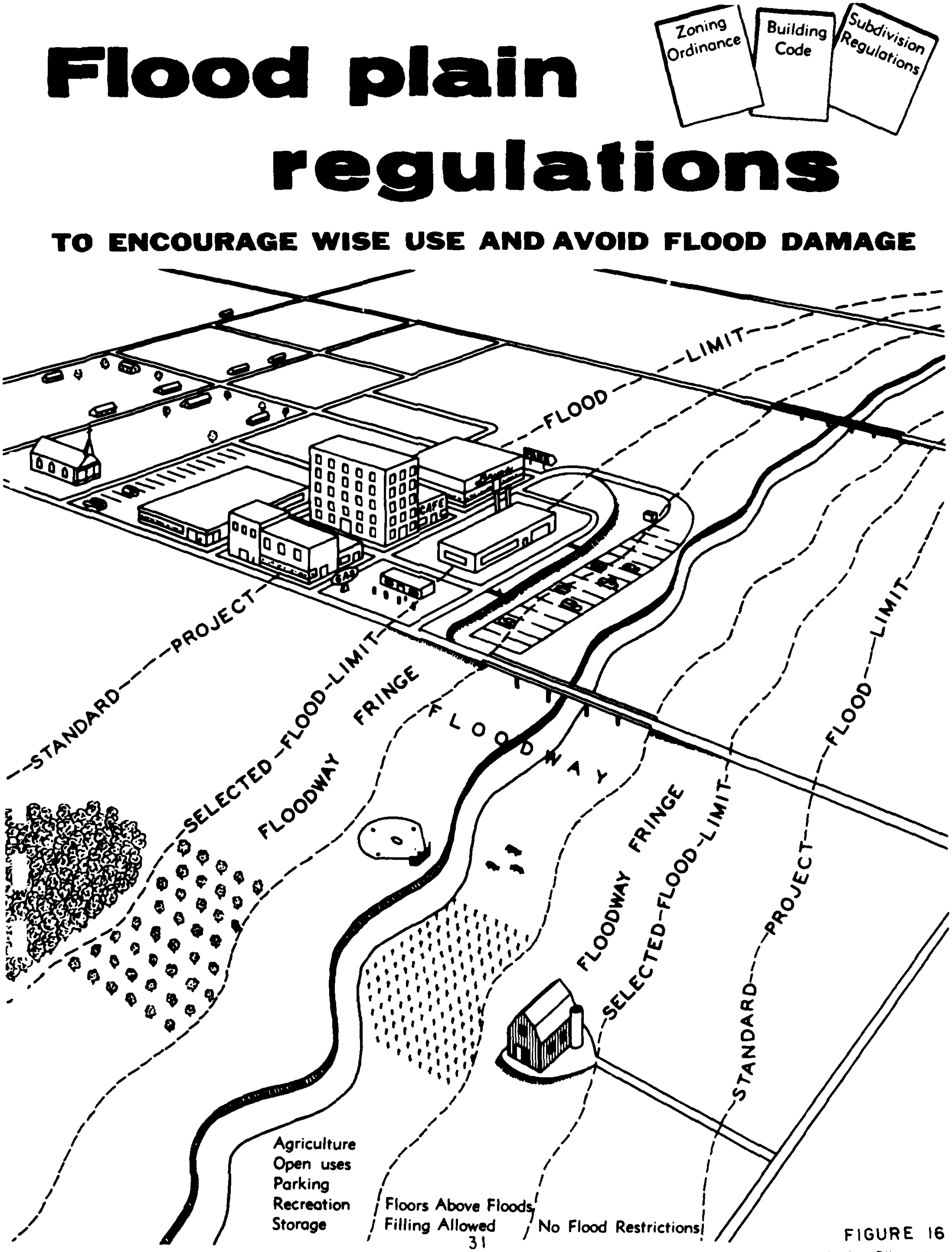



FIGURE 16

## FUTURE FLOODS

In order to determine future floods, it is desirable to study past floods on other streams in the same general region. Table 6 lists the maximum known floods at various U.S.G.S. gaging stations.

This section of the report discusses two future floods: the Intermediate Regional and the Standard Project Floods on the Cuyahoga River.

The Standard Project Flood is a severe flood of infrequent occurrence. It is possible, but unlikely, that a flood of greater magnitude could occur. The Standard Project Flood concept developed by the U. S. Army Corps of Engineers provides an indication of the upper limit of flooding in a particular area and is used to compare floods in different locations throughout the United States.

The Intermediate Regional Flood may reasonably be expected to occur more frequently than the Standard Project Flood. To avoid possible damage from floods of Intermediate Regional or Standard Project magnitude, flood plains should not be developed without consideration to possible future flood elevations, the risks involved, and possible alternatives.

TABLE 6

MAXIMUM KNOWN FLOODS DISCHARGES AT U.S.G.S. GAGING STATIONS IN THE REGION OF CUYAHOGA RIVER, OHIO

| Stream | Location Ohio | Period of Record (years) | Drainage Area (sq. mi.) | Peak discharge of record: Date | Peak discharge of record: Amount (cfs) | Peak discharge of record: per sq. mi. | Estimated Recurrence Interval (years*) |
|---|---|---|---|---|---|---|---|
| Cuyahoga River | Hiram Rapids | 34 | 151 | 23 Jan. 1959 | 3,670 | 24.3 | 25 |
| Cuyahoga River | Independence (1) | 36 | 707 | 22 Jan. 1959 | 21,000 | 29.7 | 100 |
| Cuyahoga River | Old Portage | 41 | 405 | 21 Jan. 1959 | 6,500 | 16.1 | greater than 200 |
| Sandusky River | Fremont (2) | 40 | 1,251 | 10 Feb. 1959 | 28,000 | 22.4 | 10 |
| Huron River | Milan | 16 | 371 | 4 Jul. 1969 | 57,000(3) | 153.6 | greater than 200 |
| Vermilion River | Vermilion | 16 | 262 | 5 Jul. 1969 | 45,000(3) | 171.7 | greater than 200 |
| Black River | Elyria | 22 | 396 | 4 Jul. 1969 | 33,500(3) | 84.6 | greater than 200 |
| Rocky River | Berea | 35 | 267 | 22 Jan. 1959 | 21,400 | 80.1 | 50 |
| Chagrin River | Willoughby | 37 | 246 | 22 Mar. 1948 | 28,000 | 113.8 | 60 |
| Grand River | Madison | 41 | 581 | 22 Jan. 1959 | 21,100 | 36.3 | 100 |
| Ashtabula River | Ashtabula | 35 | 121 | 22 Jan. 1959 | 11,600 | 95.9 | 35 |
| Conneaut Creek | Conneaut | 29 | 175 | 22 Jan. 1959 | 17,000 | 97.1 | 50 |

* Based on conditions of development at time of flood.

(1) The estimated peak discharge of the maximum historic flood was 30,000 cfs for the 1913 flood. It has a recurrence interval on the order of once in 200 years.

(2) The estimated peak discharge of the maximum historic flood was 63,500 cfs for the 1913 flood. It has an exceedance interval of about 500 years based on a discharge-frequency basis and about 200 years on a stage-frequency basis.

(3) Provisional.

DETERMINATION OF INTERMEDIATE REGIONAL FLOOD

The Intermediate Regional Flood is defined as a flood having a recurrence interval of once in 100 years at a designated location. However, this flood may occur in any one year or in consecutive years. A statistical analysis of stream flow records available for the basin under study is often used to determine a frequency of occurrence, but limitations in such records usually require analysis of rainfall and runoff characteristics in the "general region" of the area. Although the Intermediate Regional Flood represents a major flood, it is much less severe than the Standard Project Flood.

Results of the studies indicate that the Intermediate Regional Flood on Cuyahoga River at the Hiram Rapids gaging station would have a peak discharge of 4,900 cubic feet per second.

DETERMINATION OF STANDARD PROJECT FLOOD

Only in rare instances has a specific stream experienced the largest flood that can be expected to occur. It is a commonly accepted fact that sooner or later a larger flood can and probably will surpass the maximum known flood on a given stream. The Corps of Engineers, in cooperation with the National Weather Service, has made broad and comprehensive studies and investigations based on the records of past storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Flood. The Standard Project Flood is defined as the flood that can be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical region involved. Although the Standard Project Flood has only a rare chance of occurrence, it is not the most severe flood that could occur. The Standard Project Storm rainfall used for the Cuyahoga River at the Hiram Rapids gage amounts to 10.34 inch for 24 hours, 12.04 inches for 48 hours, 13.43 inches for 72 hours, and a total of 14.02 inches in 96 hours. Rainfall of this magnitude has recently been recorded in the region. In July 1969 in

Wooster, Ohio 9.37 inches of rain fell in 24 hours, and a total of 10.69 inches fell in 96 hours. The peak discharge of the Standard Project Flood on Cuyahoga River at the U.S.G.S. gaging station at Hiram Rapids is 18,300 cfs. The Standard Project Flood discharge was based on the assumption that there would be no storage in the reservoirs in the upper basin of the Cuyahoga River.

FREQUENCY - It is not practical to assign a frequency to a Standard Project Flood. However, the flood could occur during any year.

POSSIBLE LARGER FLOODS - Floods larger than the Standard Project Flood are possible. However, the combination of factors that would be necessary to produce such floods seldom occur.

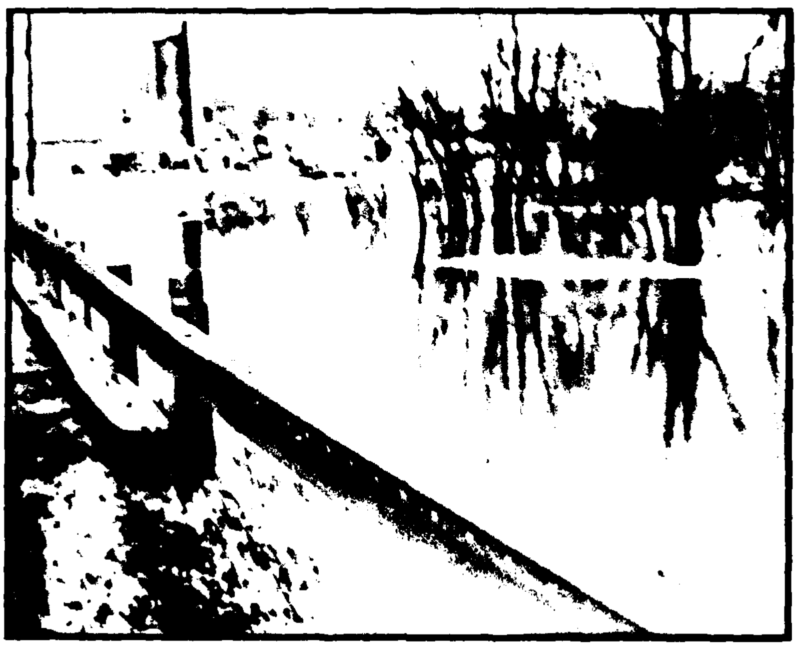


Exhibit 6 - LOOKING NORTHEAST FROM STATE ROUTE 44 BRIDGE

## HAZARDS OF GREAT FLOODS

AREAS FLOODED AND HEIGHTS OF FLOODING - The areas along the Cuyahoga River inundated by the Standard Project and Intermediate Regional Floods are shown on plates 5 and 6. Depths of flow for the Standard Project Flood, the Intermediate Regional Flood, and the January 1959 flood can be estimated from the profiles and valley sections which are shown on plates 7 through 10.

The January 1959, the Intermediate Regional and the Standard Project flood profiles were computed by using stream characteristics for selected reaches as determined from observed flood profiles, topographic maps and valley cross sections. The overflow areas shown on plates 5 and 6 and the water surface profiles shown on plates 7 and 8 have been determined with an accuracy consistent with the purpose of this study and the accuracy of the available basic data. The water surface profiles depend to a great extent upon the degree of destruction or clogging of various bridges during the flood occurrence. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand and that no clogging would occur.

In the study area the Standard Project Flood for the Cuyahoga River is approximately 7 to 11 feet higher than the January 1959 flood stage.

The approximate heights of the Standard Project Flood, the Intermediate Regional Flood, and the January 1959 flood at selected sites are shown in figures 17 through 26.

VELOCITIES, RATES OF RISE AND DURATION OF FLOODING - Table 7 lists the average velocities that would occur in the channel and overbank areas during the Intermediate Regional and Standard Project Floods.

Rates of rise are dependent upon the development, rainfall intensity, slope of the basin and loss rate of rainfall. They can also depend upon the condition of the channel and amount of debris in the channel at the time of the storm. The duration of a flood above bankfull stage is dependent upon the duration of the storm and on the assumption that the storm was caused by rainfall and does not include prolonged runoff from snow melt and high stages caused by ice jams, etc. Table 8 lists the total rise from low water to the crest, the maximum rate of rise, and the duration above bankfull stage of the Intermediate Regional and Standard Project Floods for the Cuyahoga River.

Exhibit 7 - FLOODING IN MANTUA PARK

TABLE 7

AVERAGE MAXIMUM VELOCITIES

| Vicinity Location | Stream Mile | Flood | *Average Velocities channel (ft. per sec.) | *Average Velocities overbank (ft. per sec.) |
|---|---|---|---|---|
| Ohio State Route 44 | 69.40 | Intermediate Regional | 2.6 | 1.4 |
| | | Standard Project | 4.3 | 2.5 |
| Mennonite Road | 70.19 | Intermediate Regional | 2.7 | 1.2 |
| | | Standard Project | 3.4 | 1.8 |
| Ohio State Route 82 | 72.63 | Intermediate Regional | 4.0 | 1.1 |
| | | Standard Project | 6.3 | 2.2 |
| Winchell Road | 75.80 | Intermediate Regional | 6.4 | 2.4 |
| | | Standard Project | 7.8 | 2.7 |

*Average velocity for selected location.

Velocities could be greater in isolated areas, especially in overbank section. High channel and overbank velocities, in combination with deep, fairly long-duration flooding, would create a hazardous situation in the flood plain. When velocity (in feet per second) times depth (in feet) is greater than nine, hazardous conditions prevail.

TABLE 8

RATES OF RISE AND DURATIONS OF FLOODING

AT U.S.G.S. GAGE AT HIRAM RAPIDS

STREAM MILE 75.80

| Flood | Time of rise (hrs) | Maximum rate of rise (ft/hr) | Duration above bankfull stage (hrs) |
|---|---|---|---|
| Intermediate Regional | 50 | .25 | 102 |
| Standard Project | 69 | .50 | 140 |

These rates of rise should give adequate warning that a flood is coming. However, a clogged bridge or an ice jam could act as a dam and cause water to back up and form a pond. When sufficient head accumulates in the pond to break the jam, a surge of water would flow downstream causing an almost instantaneous rate of rise.

Exhibit 8 - FLOOD WATER FLOWING ACROSS CANADA ROAD


Figure 17 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods at the gravel road bridge, stream mile 69.25.

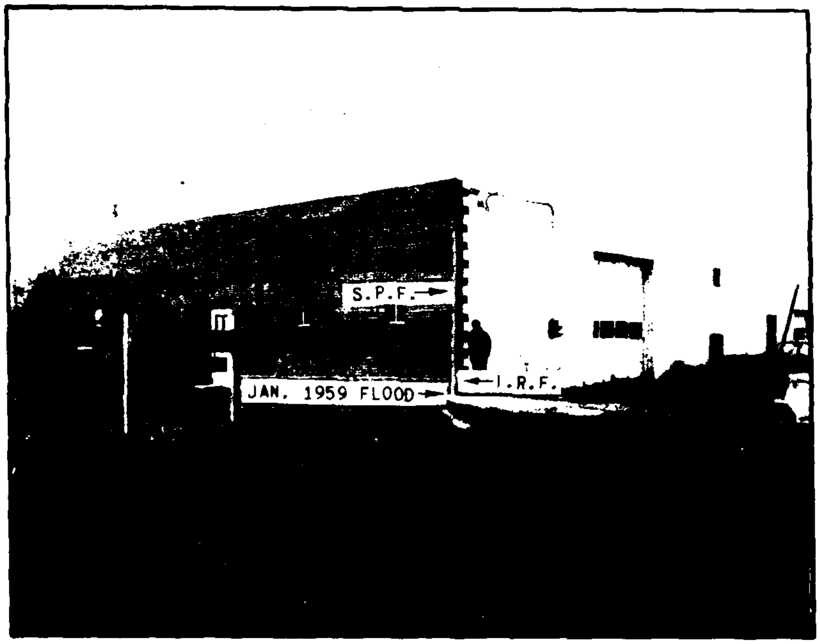



Figure 18 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods at Tummonds Corporation on State Route 44, stream mile 69.30

Possible future flood heights
Photos were taken in November 1971

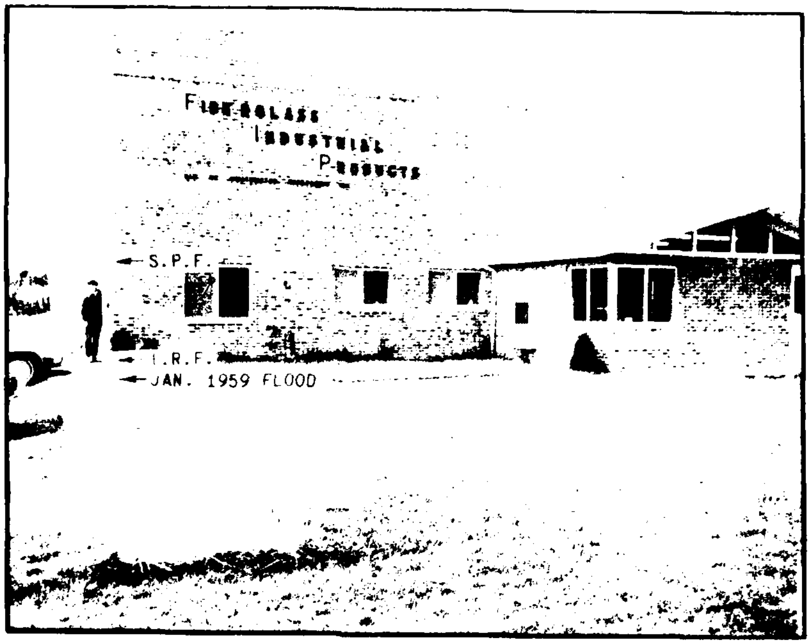



Figure 19 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods at Fiberglass Industrial Products on State Route 44, stream mile 69.33.

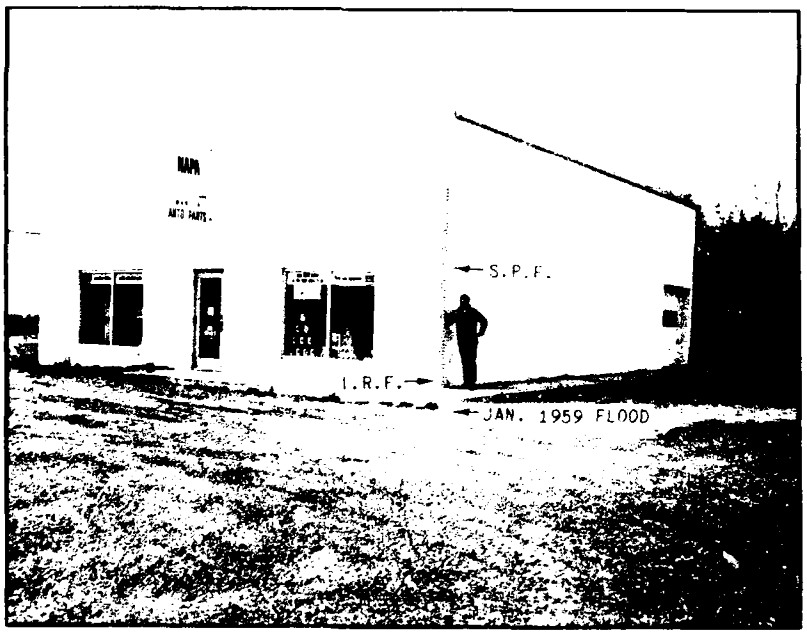



Figure 20 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods at Mantua Auto Parts on State Route 44, stream mile 69.36.

Possible future flood heights
Photos were taken in November 1971

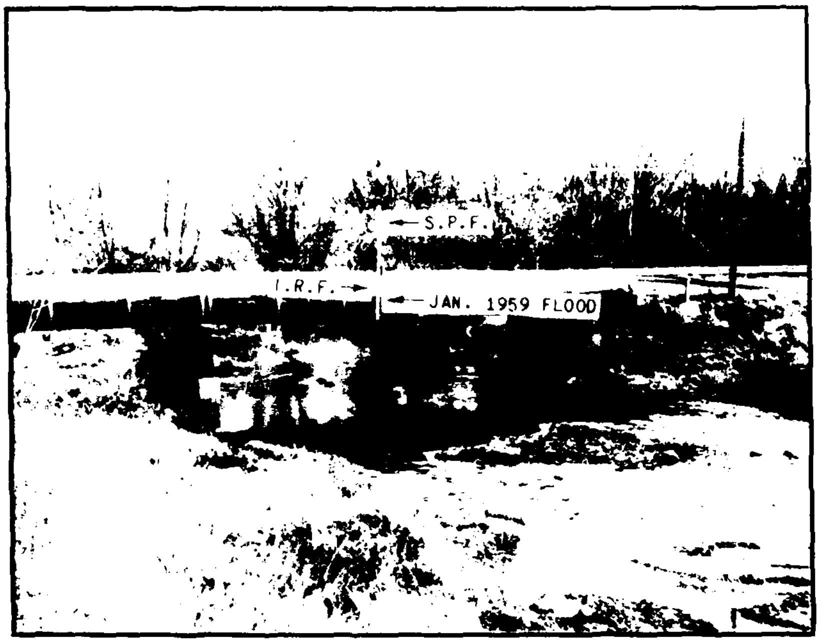



Figure 21 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods on the downstream side of State Route 44 bridge, stream mile 69.40.

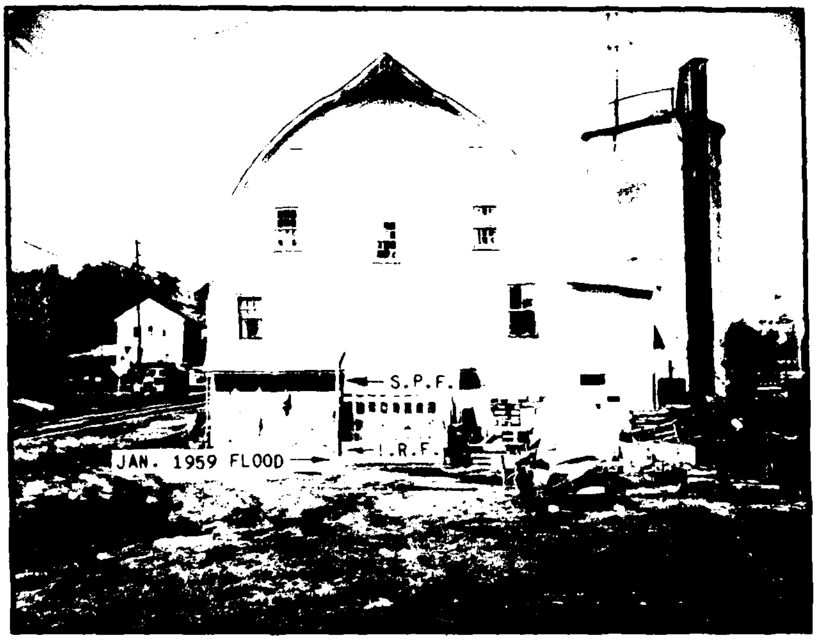



Figure 22 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods on the Modern Cement Company building upstream of State Route 44, stream mile 69.43.

Possible future flood heights
Photos were taken in November 1971

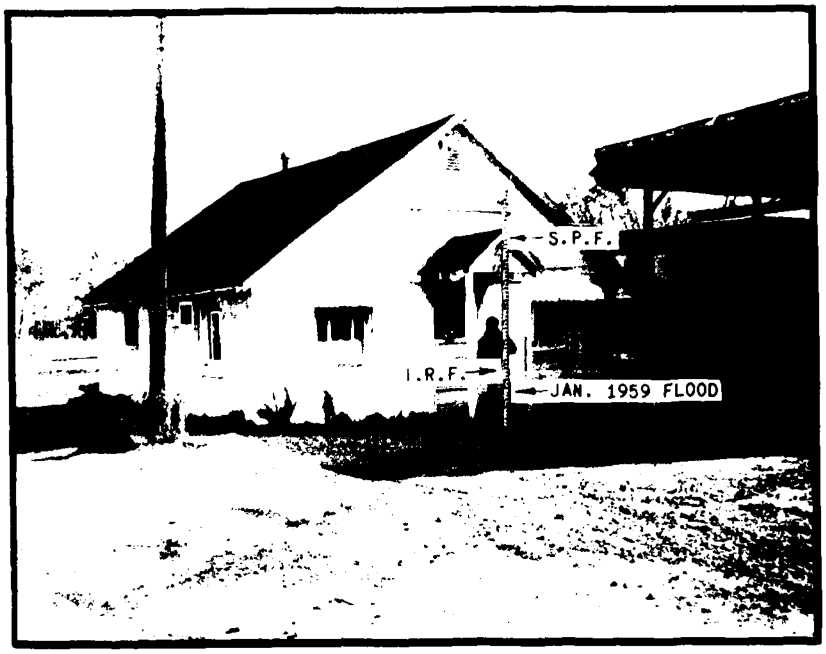



Figure 23 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods on the Wells Truck Lines office building, upstream of State Route 44, stream mile 69.45.


Figure 24 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods on a building located just downstream of Mennonite Road bridge, stream mile 70.15.

Possible future flood heights
Photos were taken in November 1971


Figure 25 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods at Allyn Road bridge, stream mile 75.63.


Figure 26 - Arrows indicate the heights of the Standard Project, Intermediate Regional, and January 1959 floods at Winchell Road bridge, stream mile 75.80.

Possible future flood heights
Photos were taken in November 1971

## GLOSSARY OF TERMS

Discharge. The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in stream flow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain. The relatively flat area or low lands adjoining the channel of a river, stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by flood water.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth, for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss. The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Hydrograph. A curve denoting the discharge or stage of flow over a period of time.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed."

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Low Steel (or Underclearance). See "underclearance."

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance. The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.

## AUTHORITY, ACKNOWLEDGMENTS AND INTERPRETATION OF DATA

PUBLIC LAW - This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (PL 86-465), as amended.

* * *

ACKNOWLEDGMENTS - The assistance and cooperation of the United States Geological Survey, National Weather Service, Ohio Department of Natural Resources, Tri-County Regional Planning Commission, various local governmental agencies in the study area, and private citizens in providing useful data are appreciated.

* * *

This report presents the local flood situation caused by the Cuyahoga River through the village and township of Mantua and Hiram Township. The U. S. Army Engineer District, Buffalo, will provide interpretation and limited technical assistance in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated through the Ohio Department of Natural Resources, Division of Water. After local authorities have selected the flood magnitude or frequency to be used as the basis for regulation, the Corps of Engineers can assist in the selection of floodway limits by providing information on the effects of various widths of floodway on the profile of the selected flood.

* * *

In our investigations we found several pictures we believe to be the February 1968 flood. These pictures are inserted throughout this report and are labeled exhibits. Exhibit page locations are shown in the table of contents following the section on Plates.

These pictures were obtained through the courtesy of Mr. C. D. Yount.

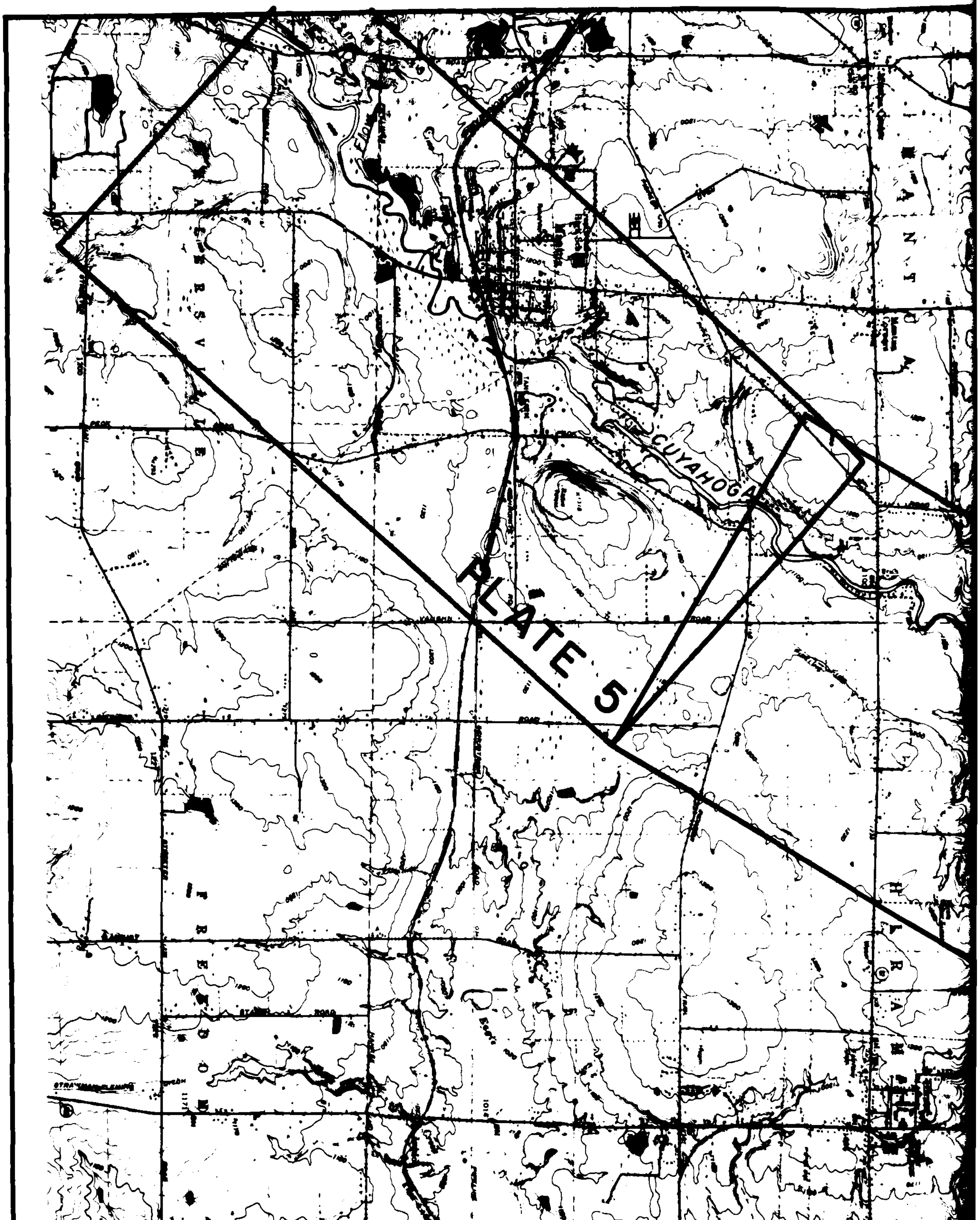
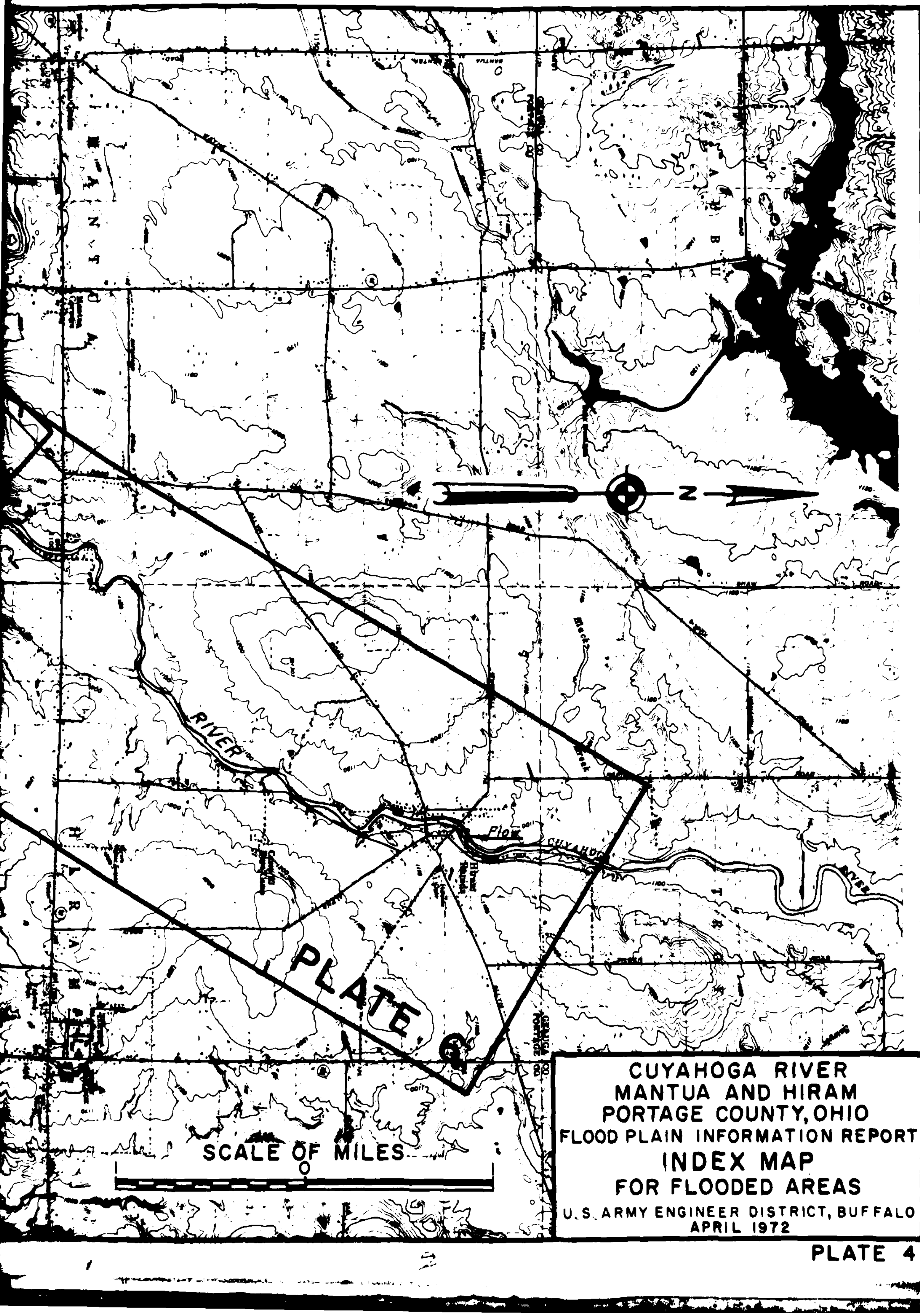
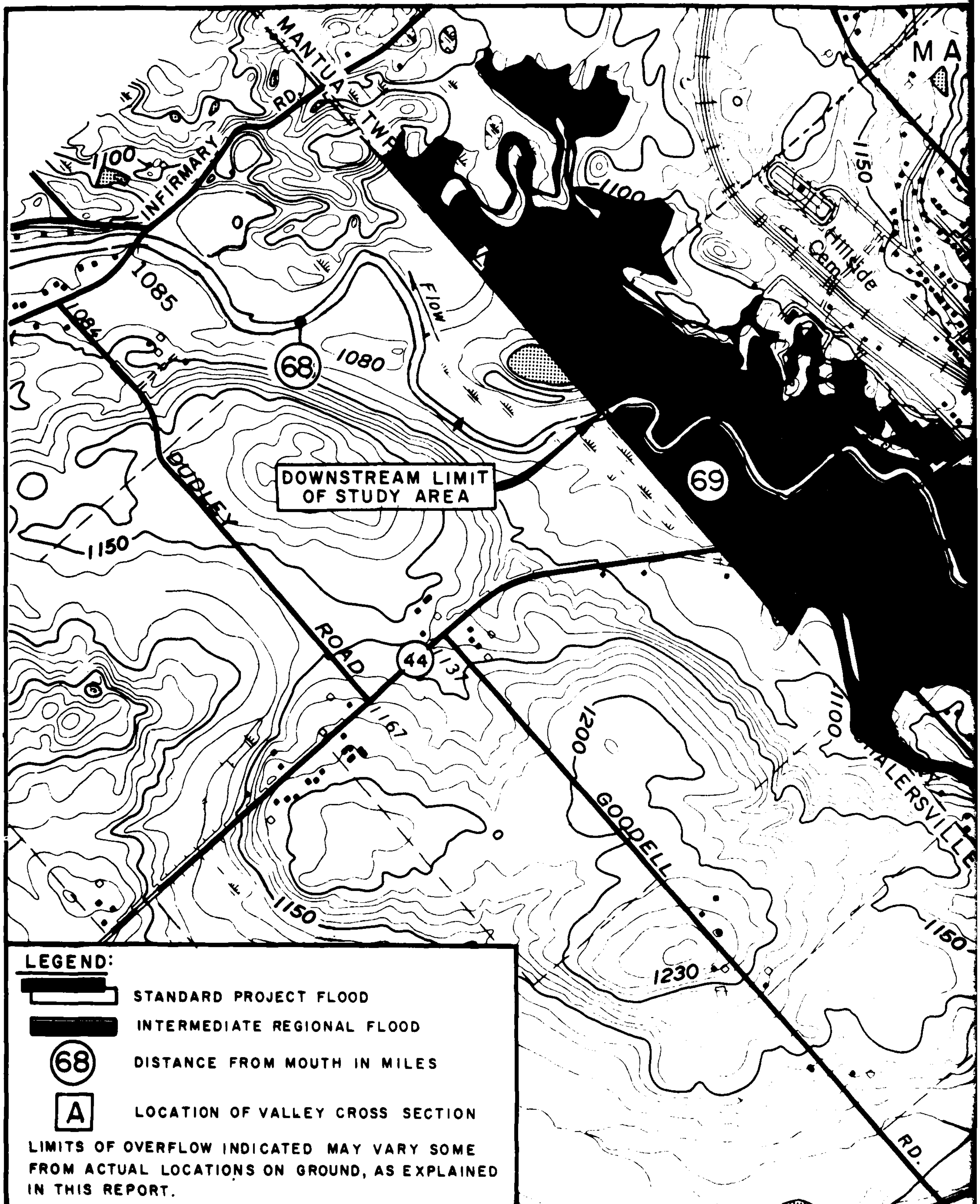
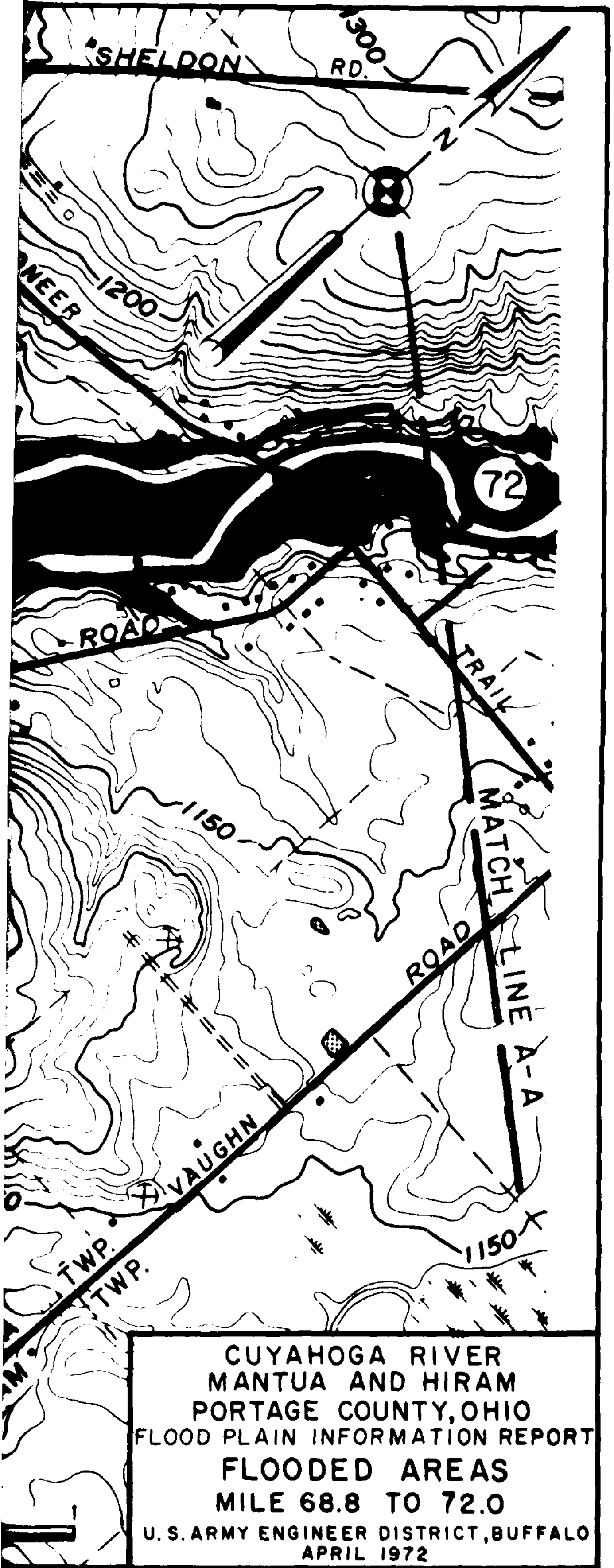


PLATE 5
CUYAHOGA


RIVER
Flow
CUYAHOGA
RIVER
PLATE 6
N
SCALE OF MILES
0
CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT
INDEX MAP
FOR FLOODED AREAS
U.S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972


MANTUA TWP
INFIRMARY RD.
DUDLEY ROAD
GOODELL RD.
HALERSVILLE
Hillside Cem.
MA
Flow
DOWNSTREAM LIMIT OF STUDY AREA
68
69
44
1100
1085
1084
1080
1150
1137
1167
1200
1230
LEGEND:
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
68 DISTANCE FROM MOUTH IN MILES
A LOCATION OF VALLEY CROSS SECTION
LIMITS OF OVERFLOW INDICATED MAY VARY SOME FROM ACTUAL LOCATIONS ON GROUND, AS EXPLAINED IN THIS REPORT.


MANTUA
Crestwood High Sch
Reservoir
CITY
BOUNDARY
PIPELINE
44
1200
1200
PIONEER
1100
71
B
70
A
FARM
PECK
x 1318
Radio Tower
MENNONITE
1150
1150
ROAD
RD
MANTUA
HIRAM
1100
1130
1107
MANTUA TWP.
TWP.
MANTUA TWP.
1110
RD.
1117
SCALE OF MILE
0
0.5

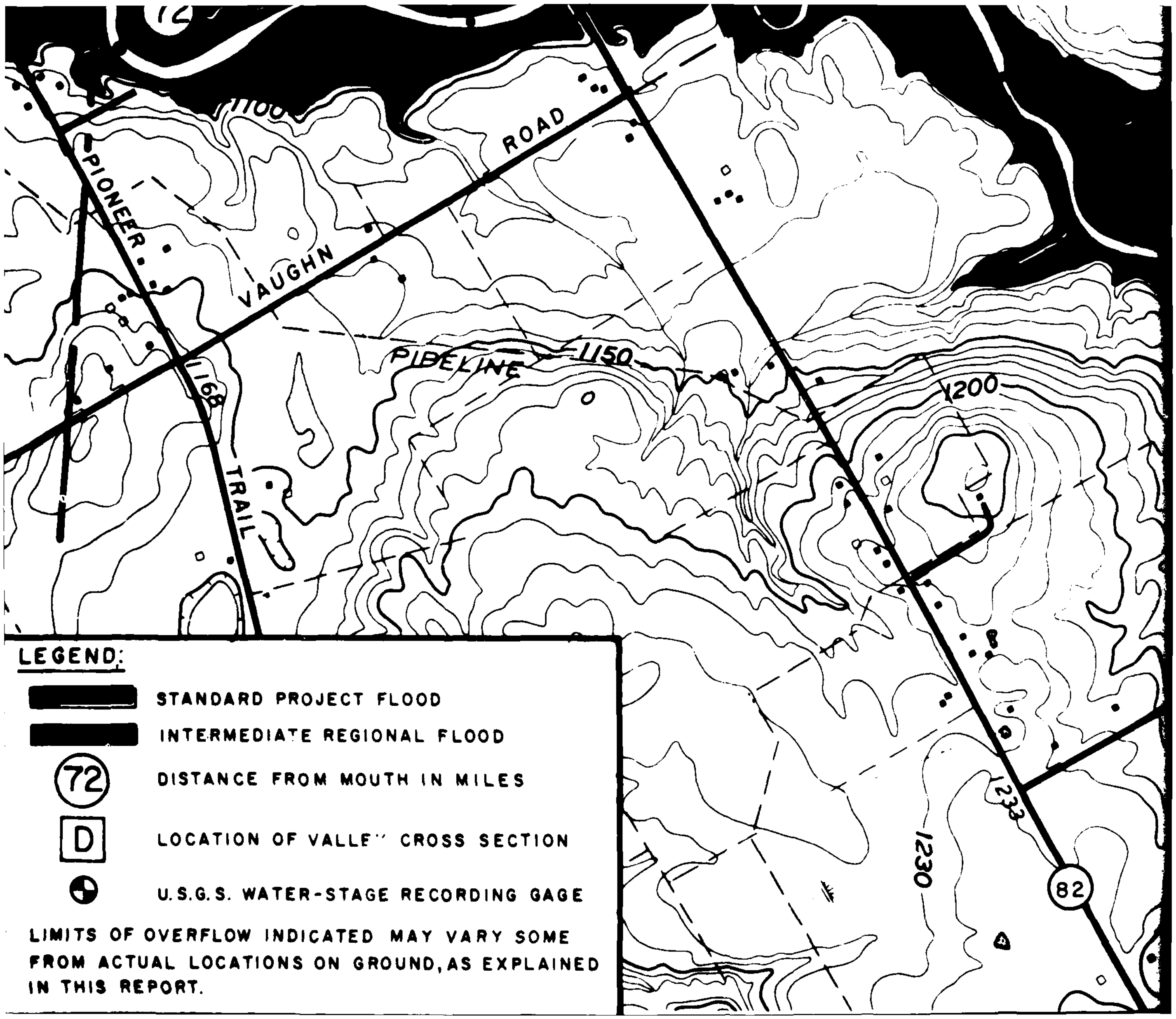



CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT

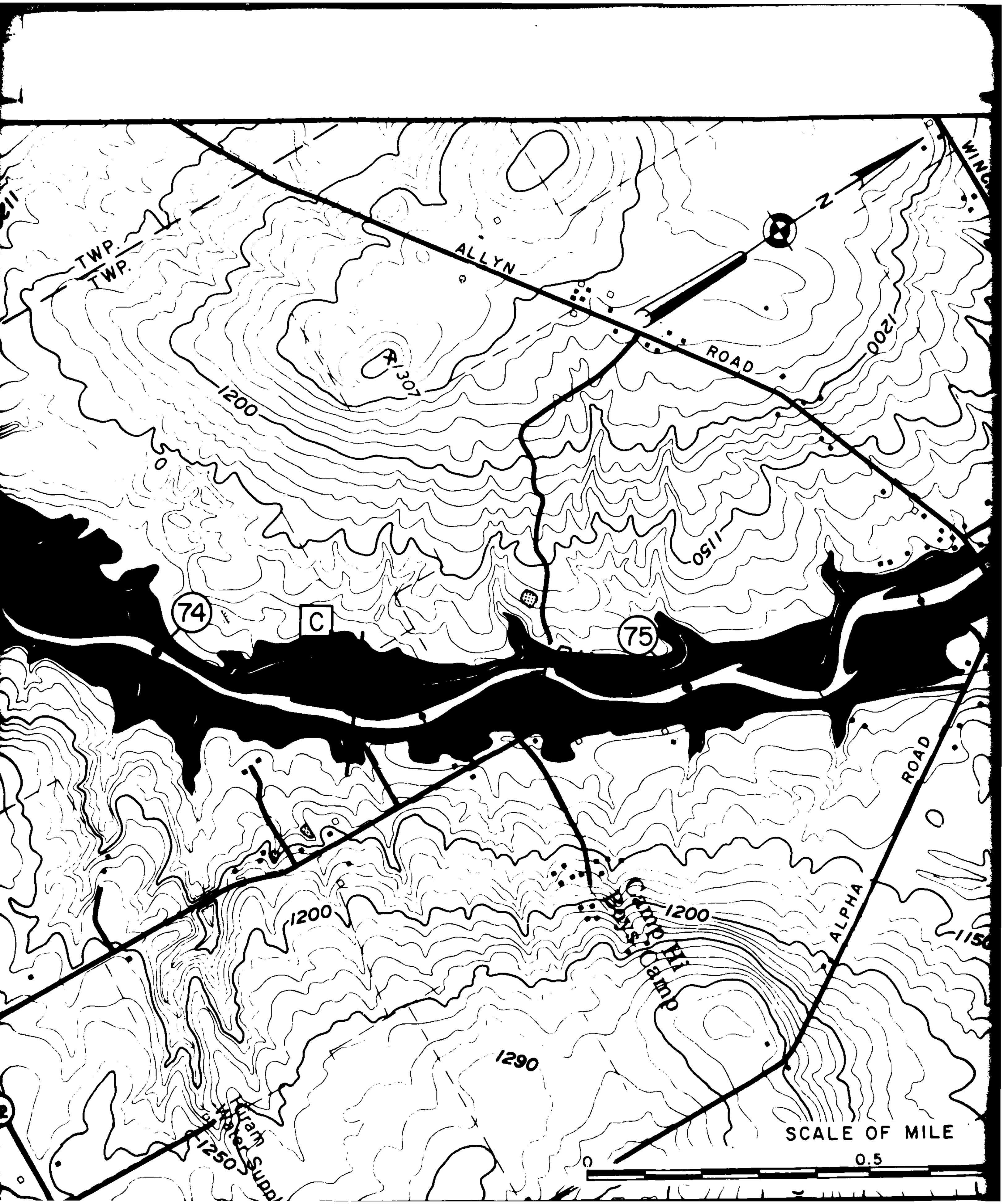
**FLOODED AREAS**

**MILE 68.8 TO 72.0**

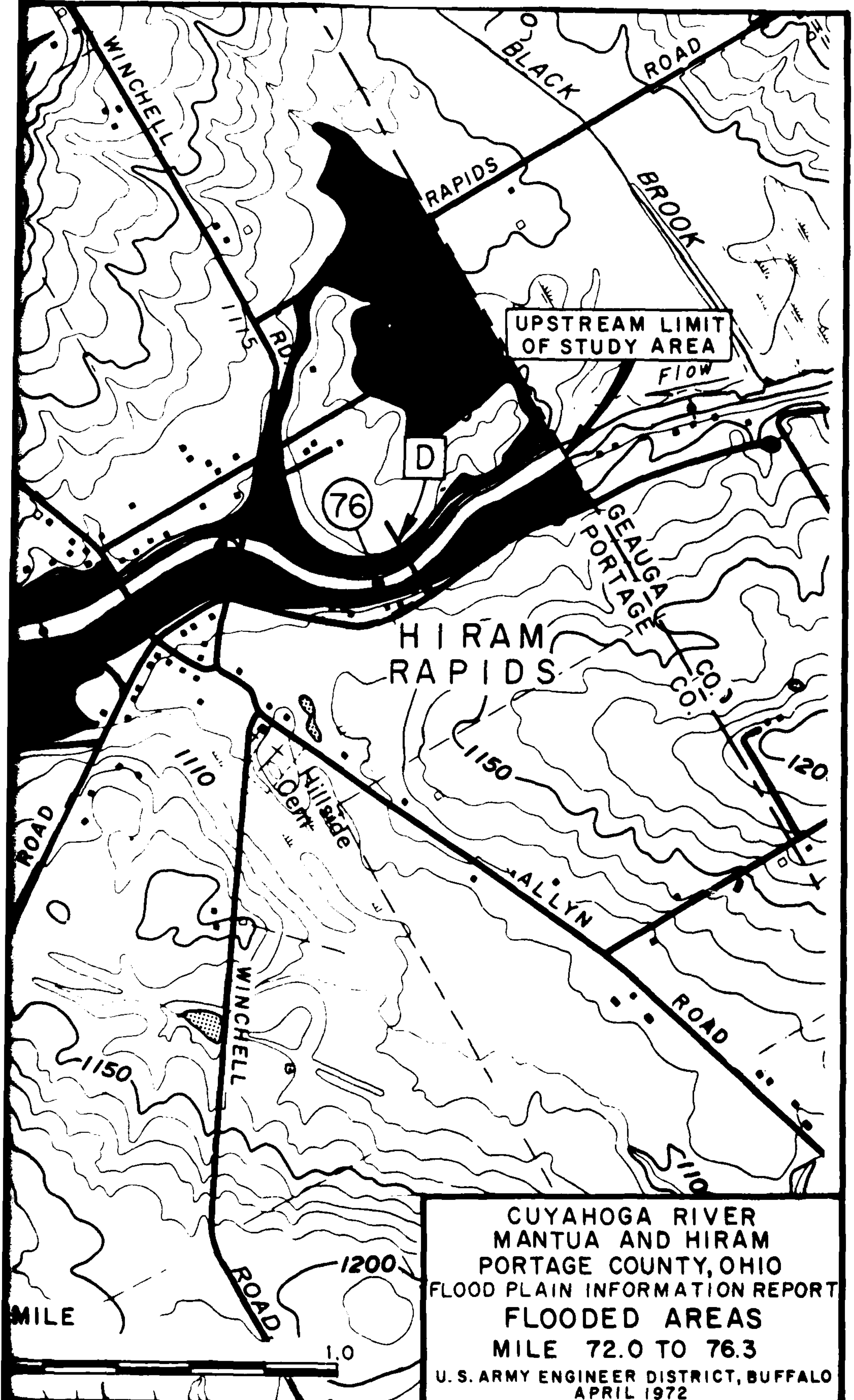
U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972



PIONEER
VAUGHN
ROAD
TRAIL
PIPELINE
1100
1150
1168
1200
1230
1233
82
LEGEND:
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
72
DISTANCE FROM MOUTH IN MILES
D
LOCATION OF VALLEY CROSS SECTION
U.S.G.S. WATER-STAGE RECORDING GAGE
LIMITS OF OVERFLOW INDICATED MAY VARY SOME FROM ACTUAL LOCATIONS ON GROUND, AS EXPLAINED IN THIS REPORT.



TWP.
TWP.
ALLYN
ROAD
1307
1200
1150
74
C
75
N
ROAD
ALPHA
1200
1200
Camp Hi
Boys Camp
1150
1290
1250
Hiram
Water Suppl
SCALE OF MILE
0.5

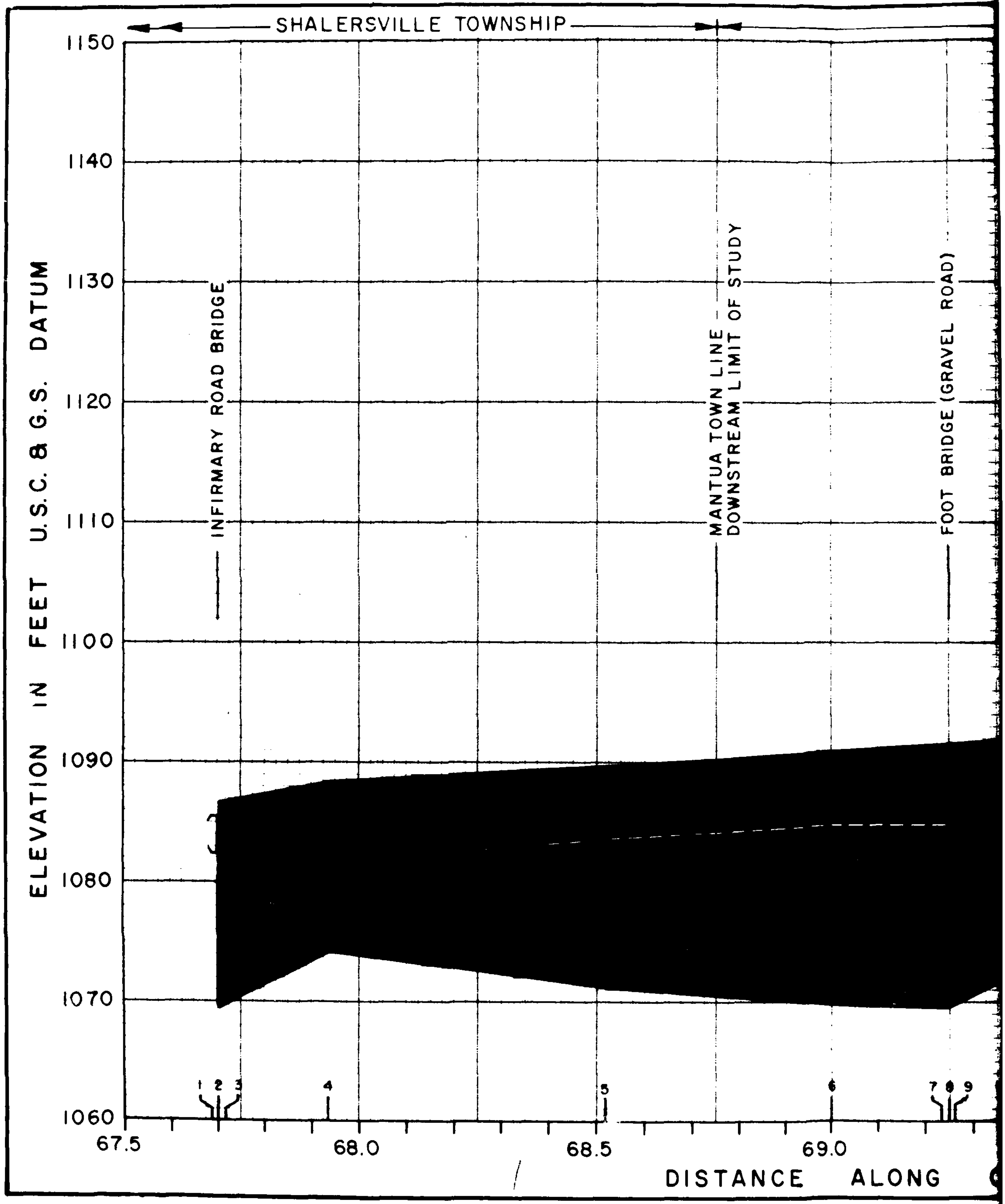



CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT

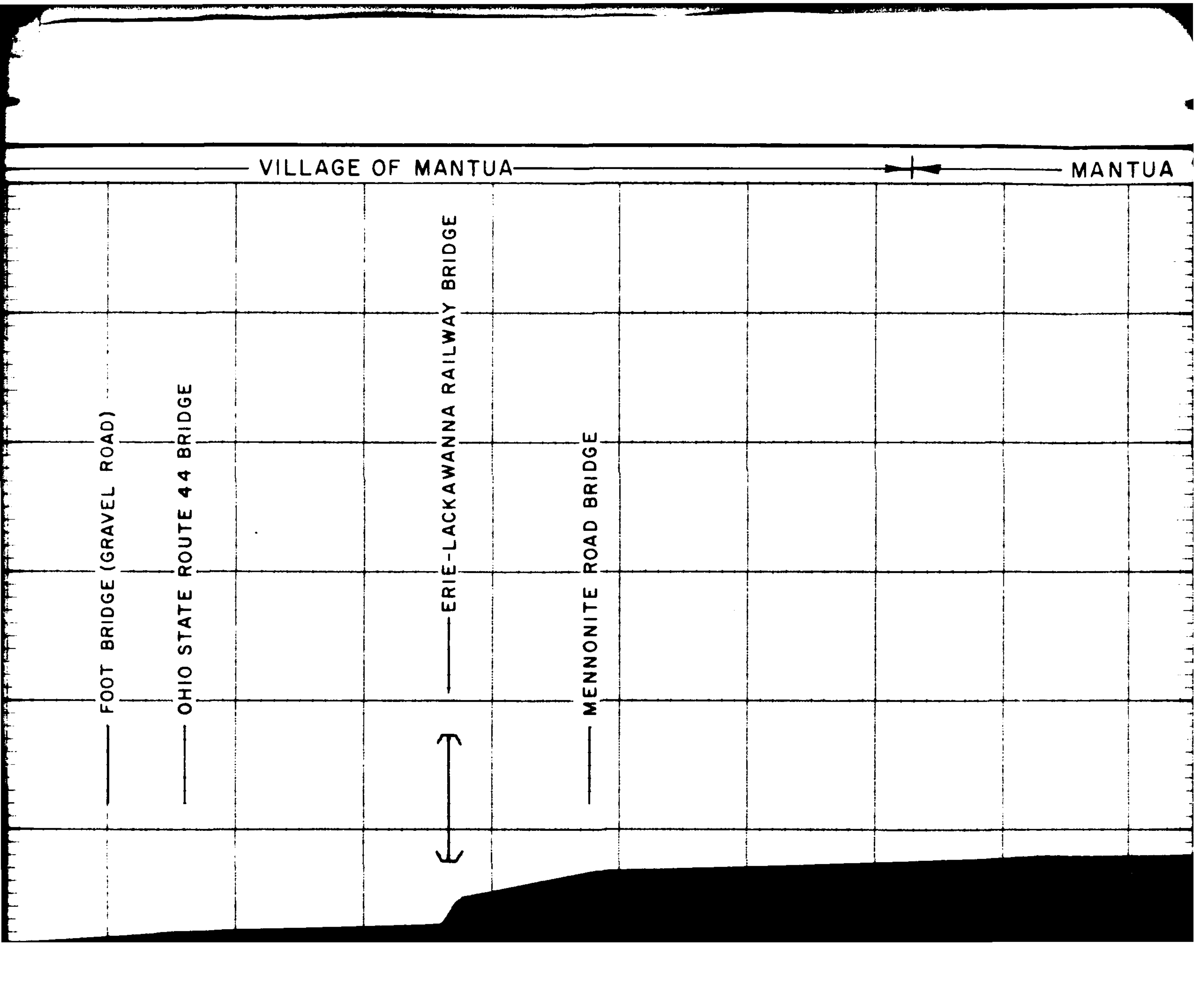
**FLOODED AREAS**

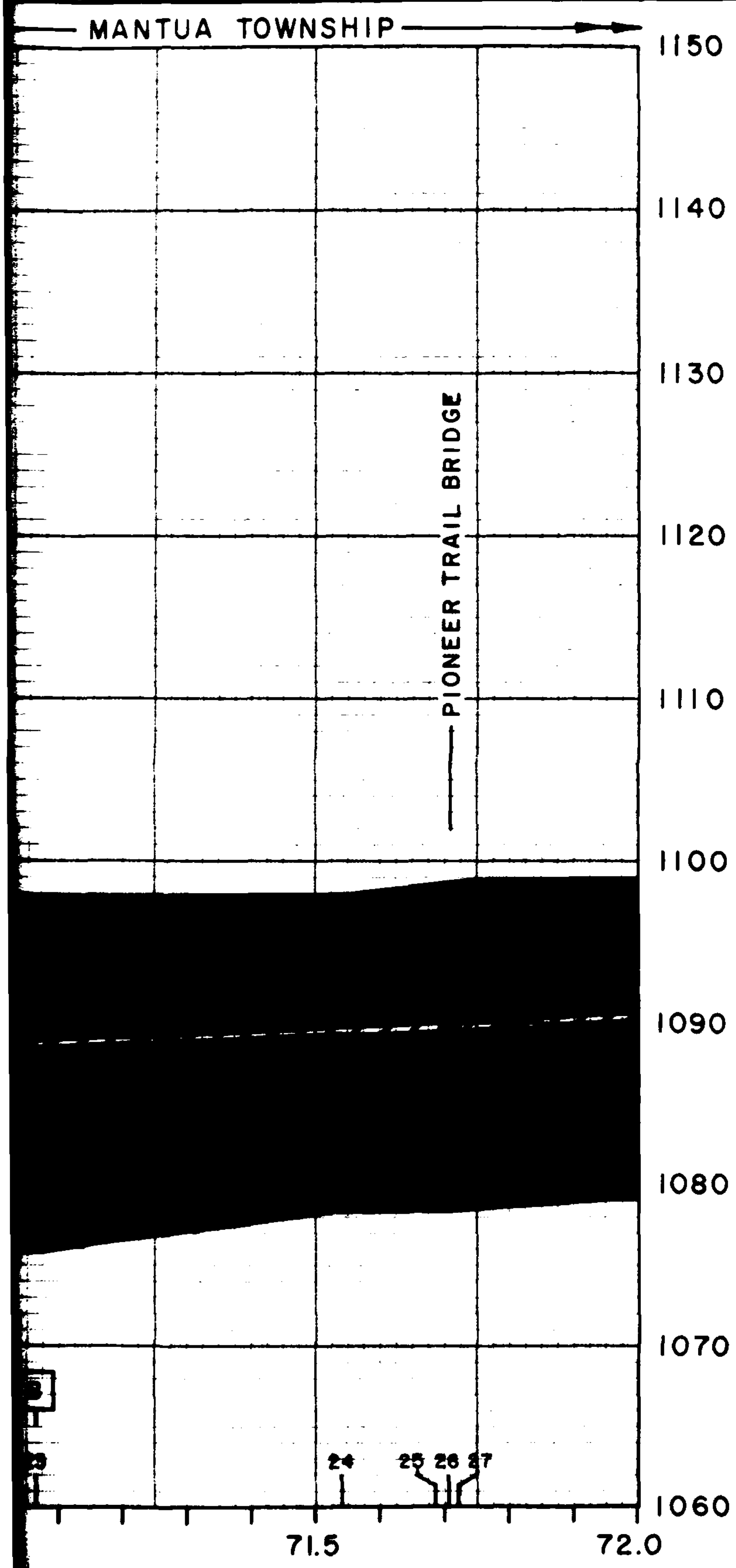
MILE 72.0 TO 76.3

U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972



SHALERSVILLE TOWNSHIP
ELEVATION IN FEET U.S.C. & G.S. DATUM
INFIRMARY ROAD BRIDGE
MANTUA TOWN LINE
DOWNSTREAM LIMIT OF STUDY
FOOT BRIDGE (GRAVEL ROAD)
1150
1140
1130
1120
1110
1100
1090
1080
1070
1060
1 2 3 4 5 6 7 8 9
67.5
68.0
68.5
69.0
DISTANCE ALONG


VILLAGE OF MANTUA
MANTUA
FOOT BRIDGE (GRAVEL ROAD)
OHIO STATE ROUTE 44 BRIDGE
ERIE-LACKAWANNA RAILWAY BRIDGE
MENNONITE ROAD BRIDGE




LEGEND:

STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
JANUARY 1959 FLOOD
APPROXIMATE STREAM BED
APPROXIMATE FLOOR ELEVATION
APPROXIMATE LOW STEEL ELEVATION
A LOCATION OF VALLEY CROSS SECTION

NOTES:

CREST PROFILES ARE BASED ON THE FOLLOWING:

1. EXISTING CHANNEL CONDITIONS
2. EXISTING STRUCTURES
3. EXISTING CONDITIONS OF DEVELOPMENT

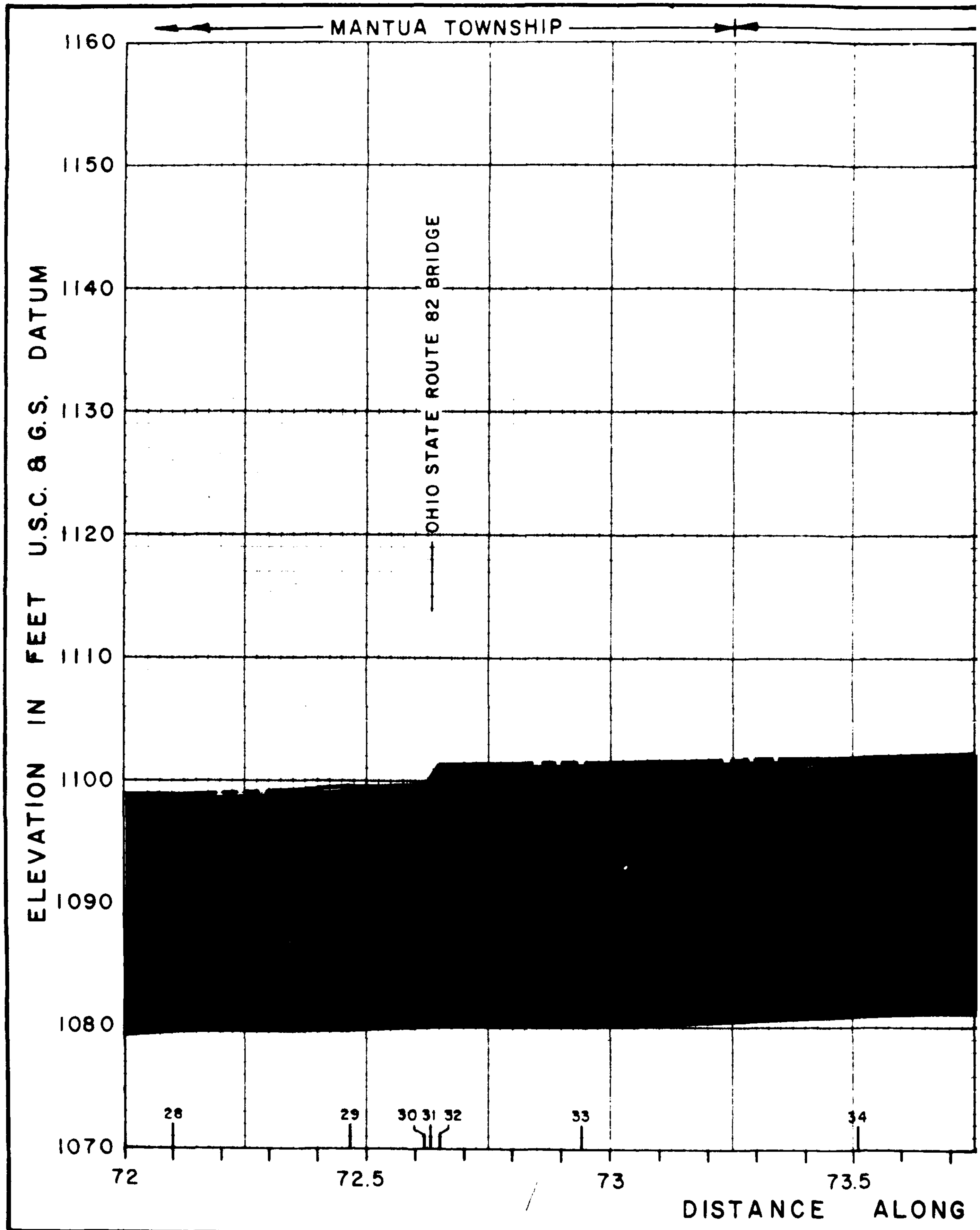
LARGE SCALE FILLING WILL RAISE PROFILES UNLESS SUFFICIENT FLOODWAY IS PROVIDED.

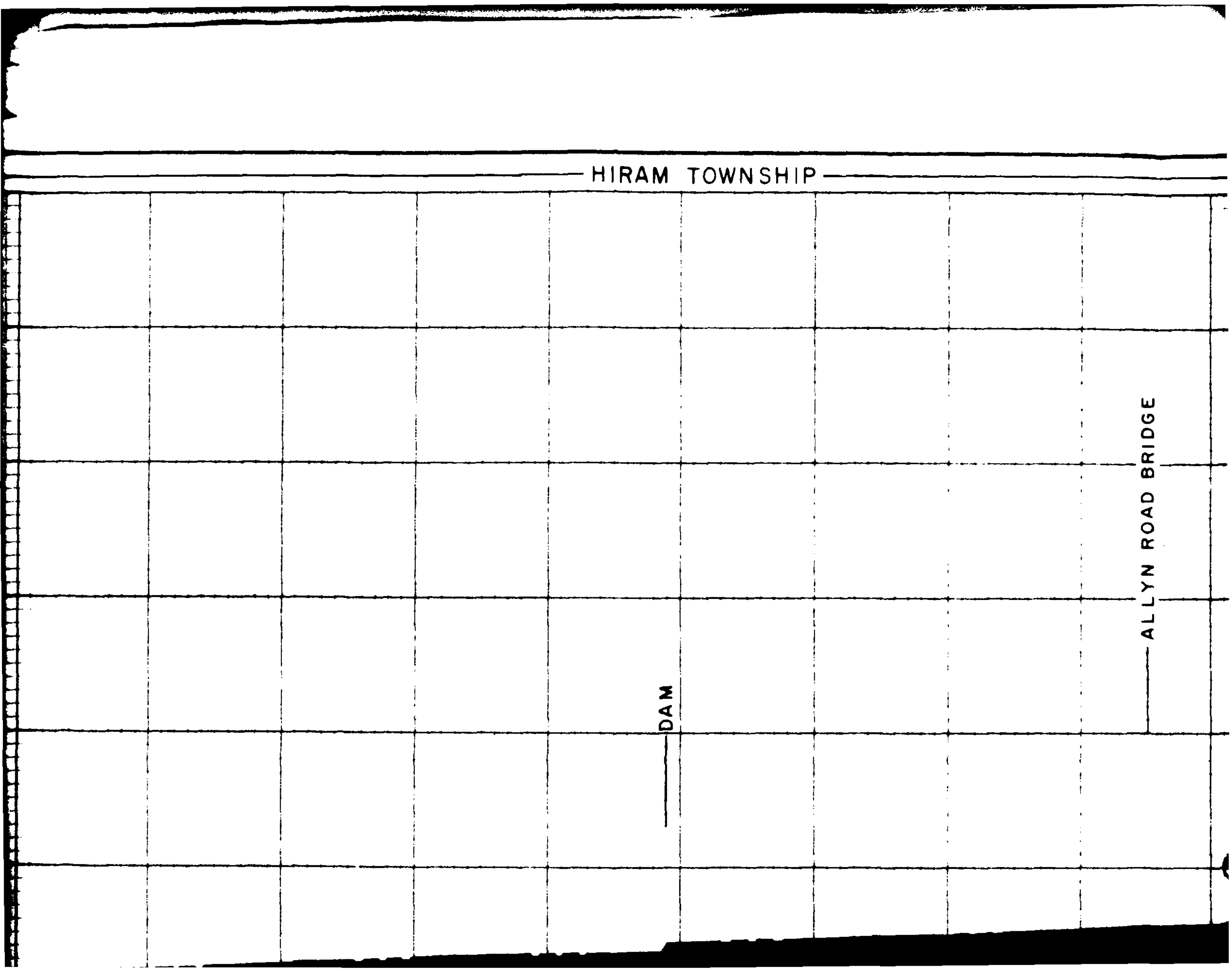
CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT

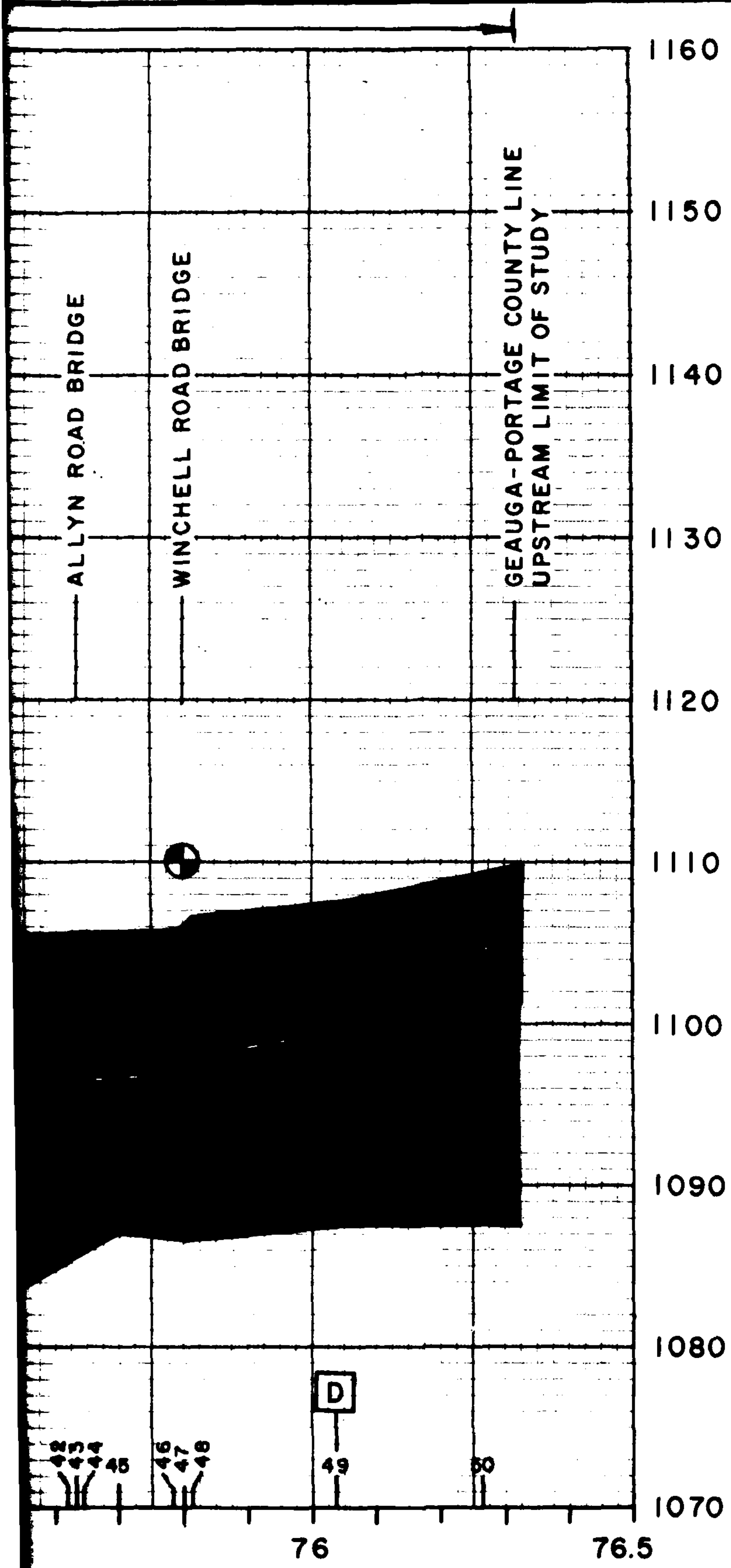
PROFILES
MILE 67.7 TO 72.0

U.S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972

PLATE 7


MANTUA TOWNSHIP
ELEVATION IN FEET U.S.C. & G.S. DATUM
1160
1150
1140
1130
1120
1110
1100
1090
1080
1070
OHIO STATE ROUTE 82 BRIDGE
28
29
30 31 32
33
34
72
72.5
73
73.5
DISTANCE ALONG


HIRAM TOWNSHIP
DAM
ALLYN ROAD BRIDGE




LEGEND:

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

JANUARY 1959 FLOOD

APPROXIMATE STREAM BED

APPROXIMATE FLOOR ELEVATION

APPROXIMATE LOW STEEL ELEVATION

D LOCATION OF VALLEY CROSS SECTION

U.S.G.S. WATER-STAGE RECORDING GAGE

NOTES:

CREST PROFILES ARE BASED ON THE FOLLOWING:

1. EXISTING CHANNEL CONDITIONS
2. EXISTING STRUCTURES
3. EXISTING CONDITIONS OF DEVELOPMENT

LARGE SCALE FILLING WILL RAISE PROFILES UNLESS SUFFICIENT FLOODWAY IS PROVIDED.

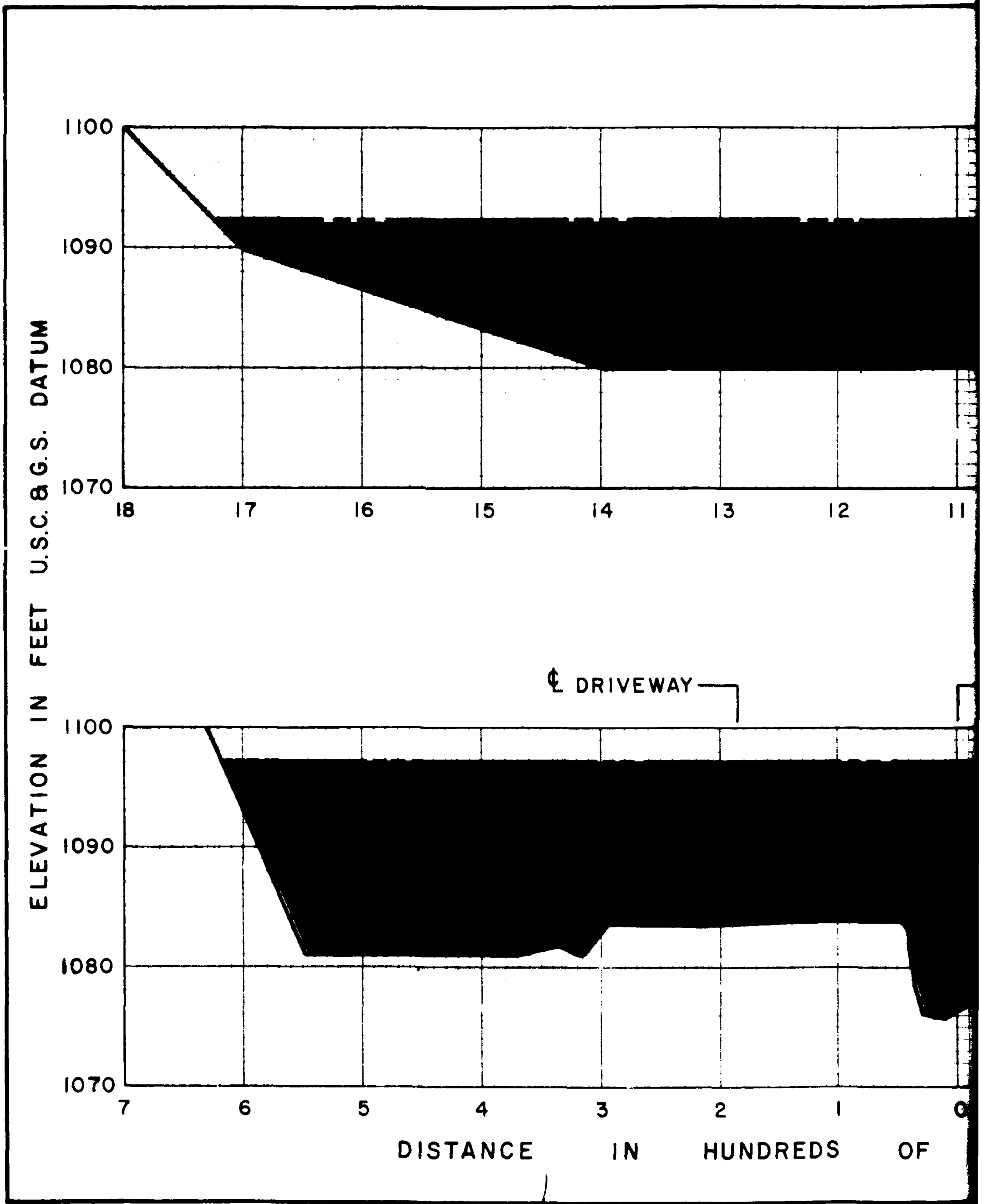
CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT

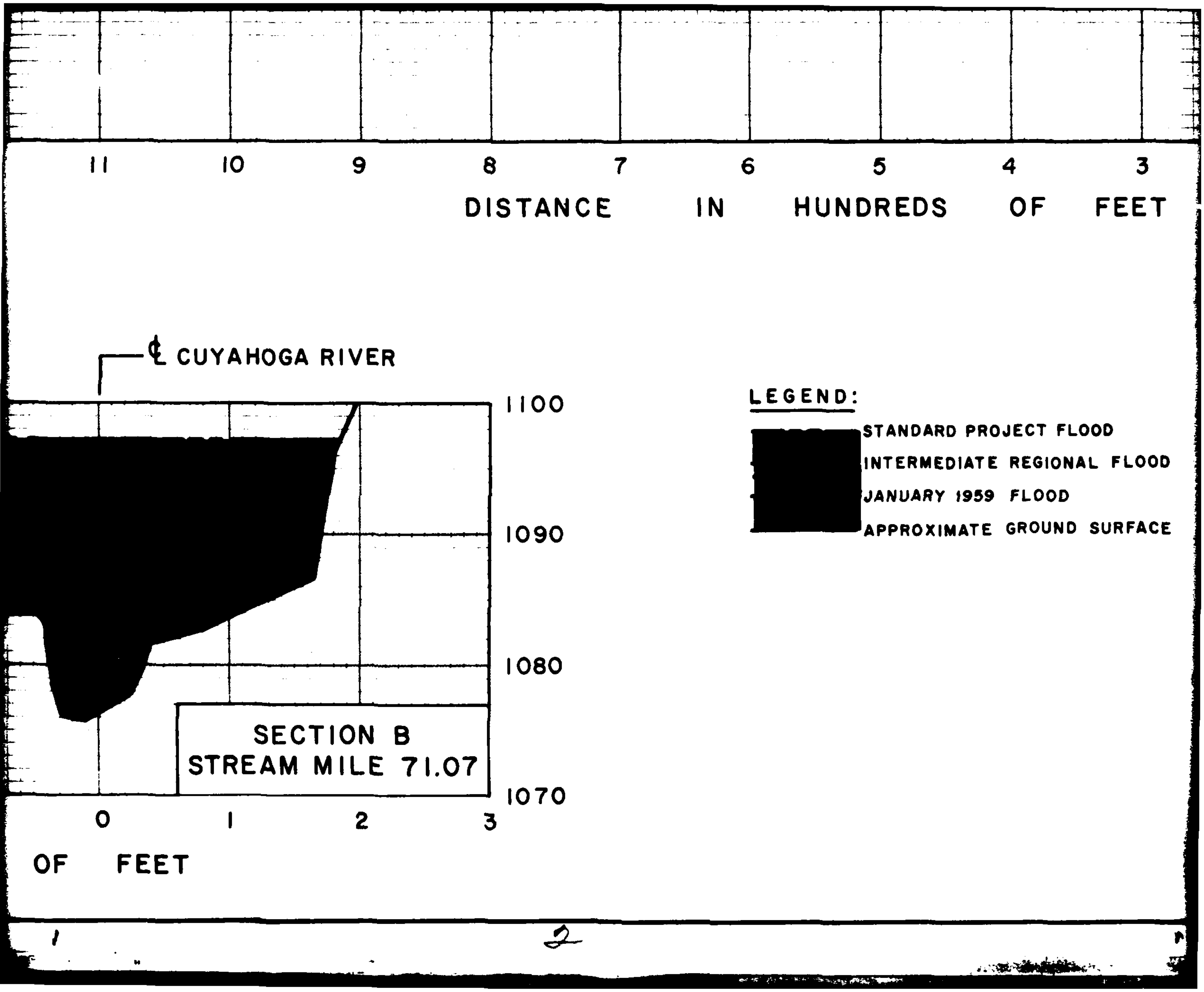
**PROFILES**

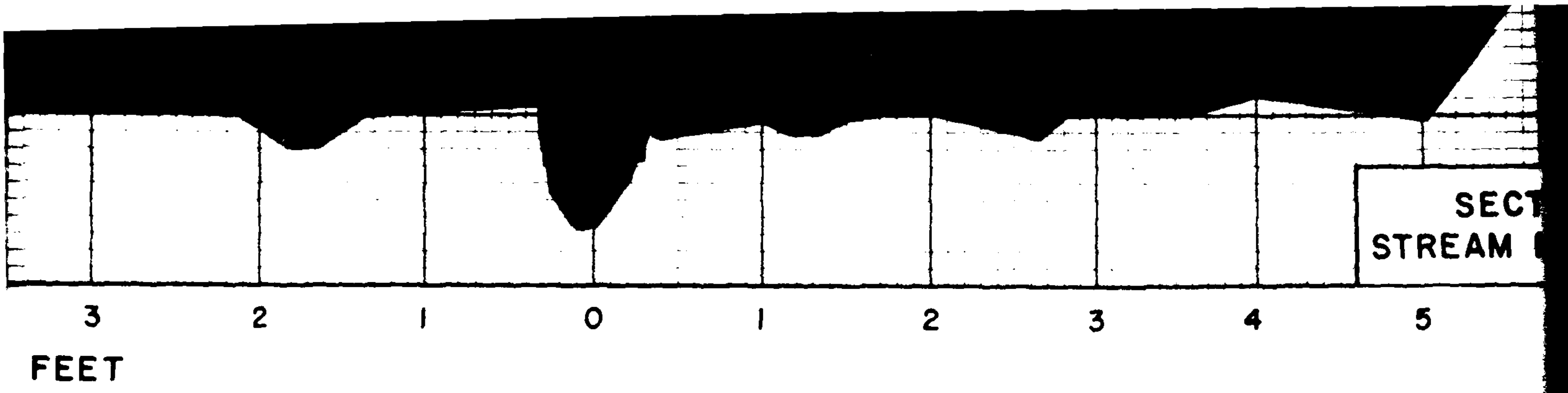
MILE 72.0 TO 76.3

U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972

PLATE 8


ELEVATION IN FEET U.S.C.&G.S. DATUM
1100
1090
1080
1070
18
17
16
15
14
13
12
11
℄ DRIVEWAY
7
6
5
4
3
2
1
0
DISTANCE IN HUNDREDS OF


11
10
9
8
7
6
5
4
3
DISTANCE IN HUNDREDS OF FEET
℄ CUYAHOGA RIVER
1100
1090
1080
1070
LEGEND:
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
JANUARY 1959 FLOOD
APPROXIMATE GROUND SURFACE
SECTION B
STREAM MILE 71.07
0
1
2
3
OF FEET
1
2




OOD

L FLOOD

SURFACE

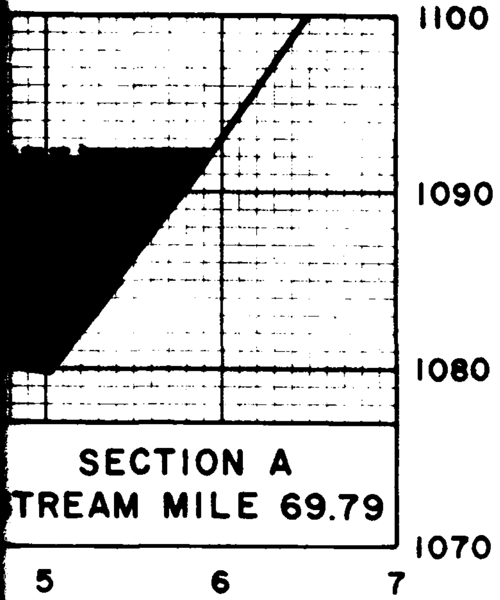
**NOTES:**

VALLEY CROSS SECTIONS ARE BASED ON ACTUAL FIELD SURVEYS AND U. S. GEOLOGICAL QUADRANGLE MAPS.

VALLEY CROSS SECTIONS ARE LOOKING DOWNSTREAM AND ARE LOCATED ON PLATE

CUY
MANT
PORTA
FLOOD PLA
VALLEY
U. S. ARMY E

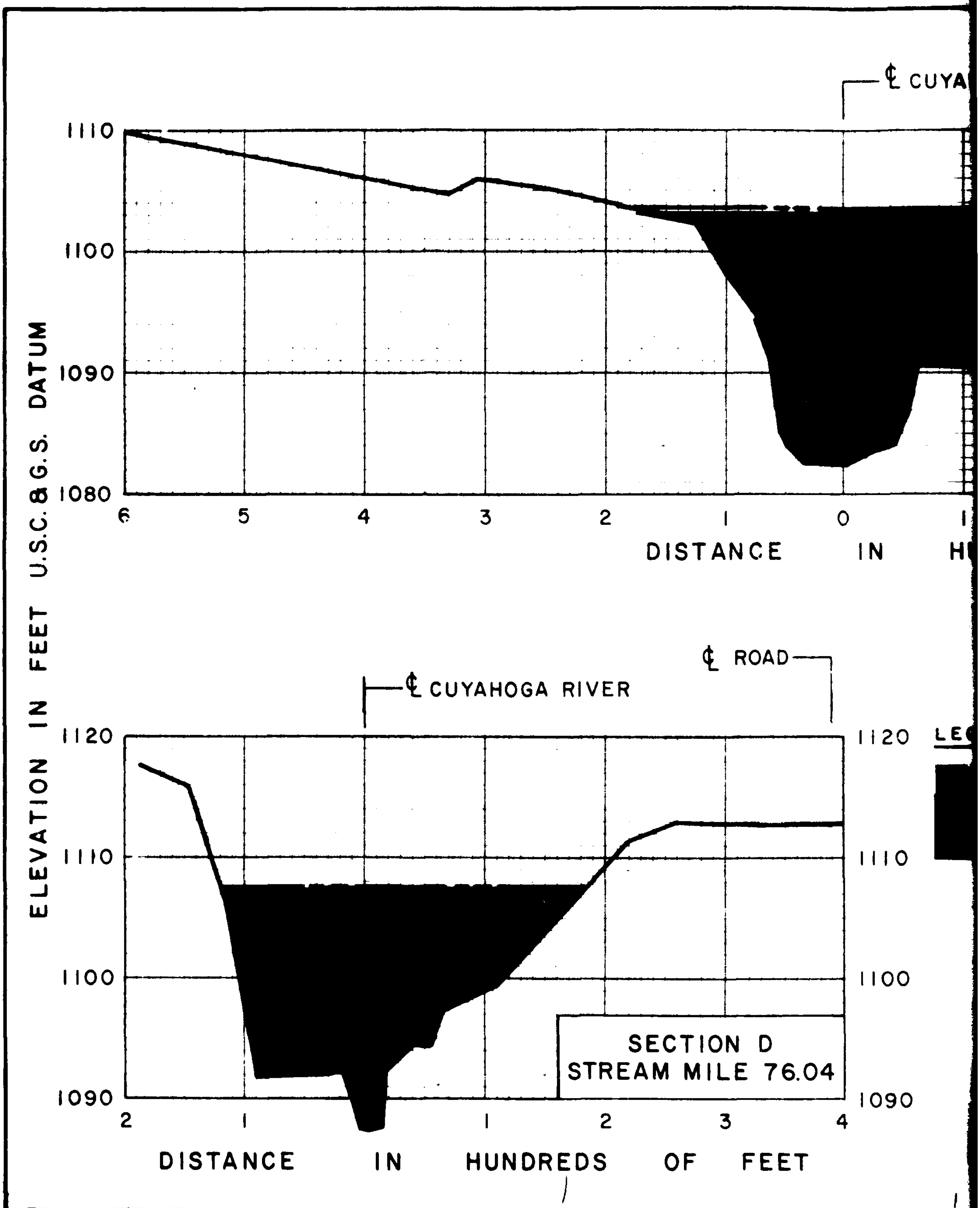
RD PARKING AREA



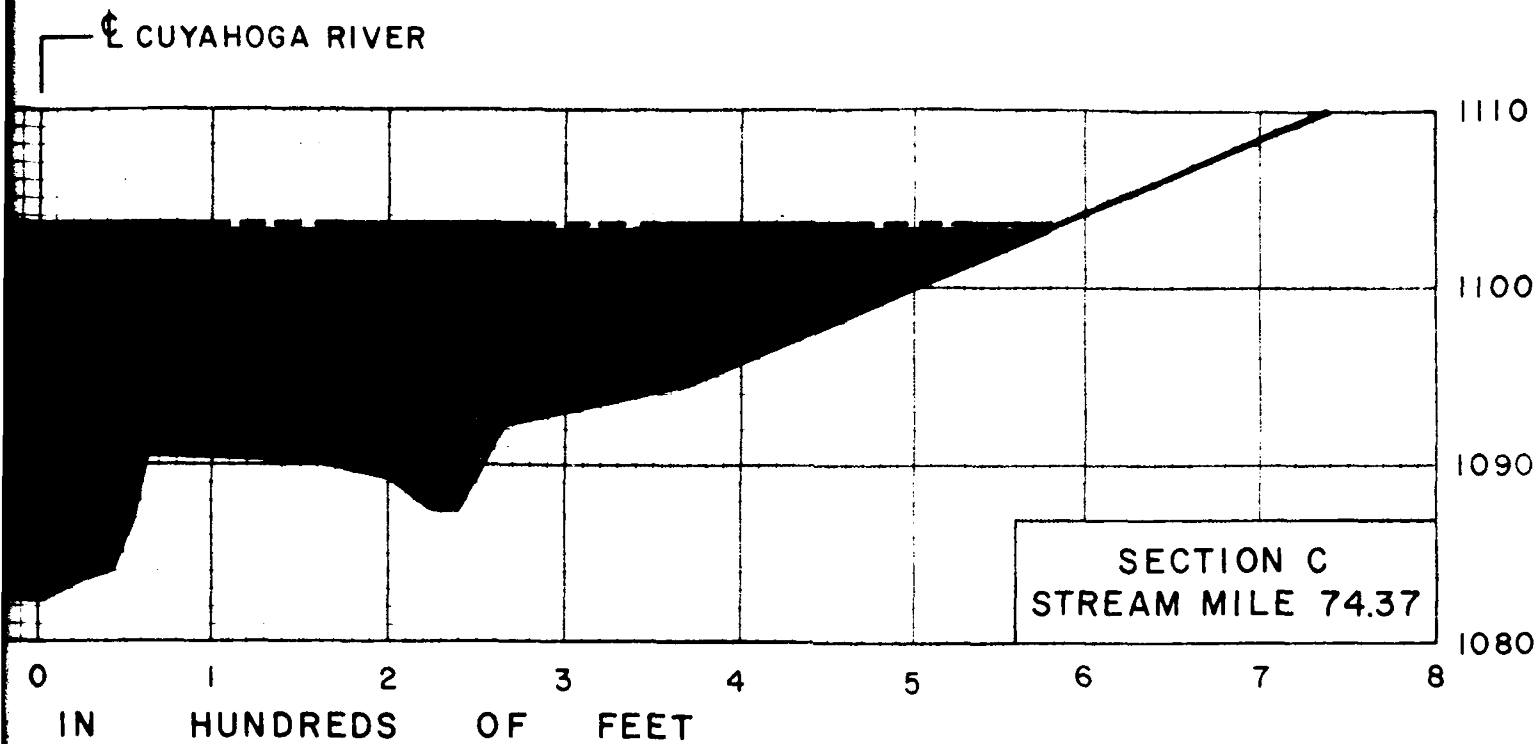

SECTION A
TREAM MILE 69.79

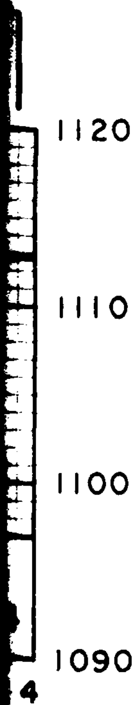
CUYAHOGA RIVER
MANTUA AND HIRAM
PORTAGE COUNTY, OHIO
FLOOD PLAIN INFORMATION REPORT
VALLEY CROSS SECTIONS
A AND B
U. S. ARMY ENGINEER DISTRICT, BUFFALO
APRIL 1972

PLATE 9



℄ CUYA
1110
1100
1090
1080
6
5
4
3
2
1
0
1
DISTANCE IN H
ELEVATION IN FEET U.S.C.& G.S. DATUM
℄ ROAD
℄ CUYAHOGA RIVER
1120
1110
1100
1090
1120
1110
1100
1090
LE
SECTION D
STREAM MILE 76.04
2
1
1
2
3
4
DISTANCE IN HUNDREDS OF FEET




**LEGEND:**

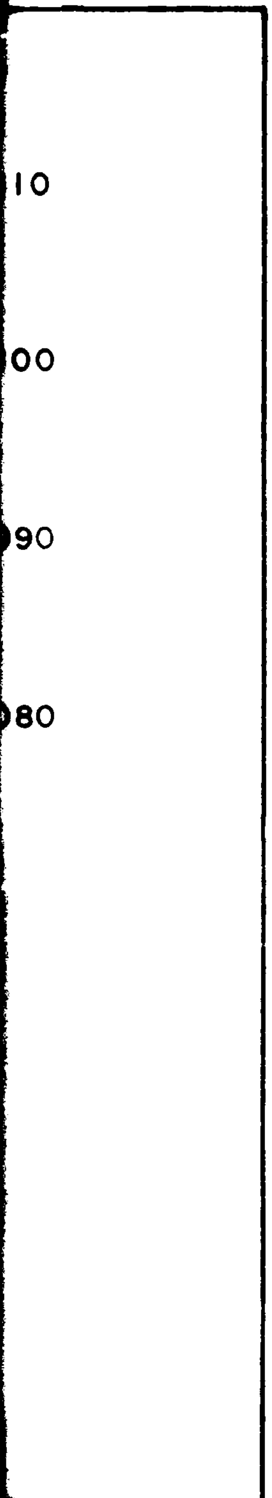
STANDARD PROJECT FLOOD
INTERMEDIATE REGIONAL FLOOD
JANUARY 1959 FLOOD
APPROXIMATE GROUND SURFACE

**NOTES:**

VALLEY CROSS SECTIONS ARE BASED ON ACTUAL FIELD SURVEYS AND U. S. GEOLOGICAL QUADRANGLE MAPS.

VALLEY CROSS SECTIONS ARE LOOKING DOWNSTREAM AND ARE LOCATED ON PLATE

CUYAHOGA RIV
MANTUA AND HIR
PORTAGE COUNTY, O
FLOOD PLAIN INFORMATIO
VALLEY CROSS SE
C AND D
U. S. ARMY ENGINEER DISTRIC
APRIL 1972




A RIVER
ND HIRAM
UNTY, OHIO
RMATION REPORT
S SECTIONS
D D
DISTRICT, BUFFALO
972

PLATE 10

Cuyahoga River "Reference Marks" - Mantua

| Reference Mark Location | | Elevation (U.S.C. & G.S. Datum) |
|---|---|---|
| Infirmary Rd. Br. | Upstream side - chiseled "+" on top of concrete abutment - right bank. | 1085.16 |
| Gravel Rd. Br. | Upstream side - chiseled square on concrete bridge seat - left bank. | 1079.35 |
| St. Rte. 44 Br. | Downstream side - chiseled "+" on top of steel upright for guard rail being the most southerly upright on left bank. | 1085.38 |
| Erie-Lack. R.R. Br. | Downstream side - chiseled square on concrete abutment being the first step from top of abutment - left bank. | 1104.42 |
| Mennonite Rd. Br. | Upstream side - chiseled square on top of concrete wing wall - left bank. | 1087.65 |
| Pioneer Trail Br. | Upstream side - chiseled square on top of concrete wing wall - left bank. | 1091.31 |
| St. Rte. 82 Br. | Downstream side - bronze disc on right concrete wing wall. | 1099.96 |
| Allyn Rd. Br. | Downstream side - chiseled square on top of 1st stone of wing wall - left bank. | 1098.98 |
| Winchell Rd. Br. | Upstream side - chiseled square on top of left concrete abutment | 1100.38 |

LMED

8